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STANDBY STATUS REPORT - HOT SEMIWORKS FACILITY

by

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STAND-BY STATUS REPORT - HOT SEMIWORKS FACILITY

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INTRODUCTION

This report is written to provide information concerning the status of the Hot Semiworks facility as it is placed in stand-by on July 1, 1957. The plant was constructed in 1951 and early 1952. It was operated on Redox type investigations until the last part of 1953. The plant was then converted to the Purex flowsheet under Project CA 513 D. Operations on the Purex type investigations were started in early 1955 and continued until early in 1956. At that time a maintenance program for plant improvement and repair was initiated. This program was completed on July 1, 1957.

Statements are contained in this report which pertain to the present status of physical equipment and facilities and the adequacy, operating experience, recommendations for improvement, previous work, and future considerations of the plant. However, the primary intent of the report is to provide pertinent information to personnel associated with a future start-up. For this reason, certain parts of the report are quite detailed. Only statements concerning the existing or previous state of the facility and equipment are factual. Others are opinions or experiences of plant operating personnel. Emphasis has also been placed on the faults encountered rather than the good features of the plant, in order that these faults might be corrected in the future.

Summary

The Hot Semiworks facility is approximately ready to process HAPO production type slugs under processing conditions of Purex flow sheet HW#3. The plant has an approximate instantaneous processing capacity of 430 pounds of U per day (6.5 tons/mo). A few modifications could probably boost this to 610 lbs per day (9.2 tons/mo). Additional flow sheet modifications and equipment changes would increase the capacity in proportion to the financial expenditure. An expected six months start-up and training period is required before operations at the plant could resume, although most of the equipment is ready to operate.

The plant was plagued by numerous equipment failures during its operation, and a number of decontaminations were necessary to permit equipment repair. In early 1956 a maintenance program was started to eliminate many of the previous difficulties and to place the plant in a more operable condition. During this program a new stainless steel floor was installed in A-cell; many of the process lines (essentially all critical ones) were changed to all-welded piping; all of the critical A-cell jets were replaced with new all-welded jets; most of the gaskets were replaced with Teflon-Flexitallic gaskets; pump jumpers and the connector catch pan were revamped to improve remote handling; the centrifuge was overhauled; and many other trouble makers were also eliminated or altered.

In B-cell, all of the pulsers were revised to contain a piston type pulsing assembly instead of the Teflon bellows assemblies which had so frequently ruptured during operations. Valves and rotameters were inspected and repaired.

In C-cell, a lead-shielded pump house was installed to contain the C-cell pumps and to allow pump replacement without thoroughly decontaminating the cell. Additional flexibility was provided by the installation of new routings in the cell.

As of July 1, 1957, the maintenance program was discontinued and the facility was placed in a non-operating status. Three buildings 2707-C, 217-C, and 241-CX are completely winterized, while 271-C, 276-C, 201-C, 291-C, and 215-C are being heated to 50° F during the winter months to prevent freezing. (2704-C is currently loaned to CPD for office space.) Generally, all of the water to the buildings is shut off and the steam, electrical, and air services are reduced to a minimum. The Power Operations group is providing the attending services to the operating units in the area. Other functions are handled through the Hanford Laboratories landlord and Radiation Monitoring groups. General Maintenance in 200-East is providing the craft services required.

STATUS OF EQUIPMENT AND FACILITIES

BUILDING

2704-C Building (Main office building)

Status of Services - All are in service. Water, electricity, and heat are maintained.

Operating Experience - The following objections to the building arrangement were noted:

a) Traffic through the offices disrupted routine business
b) The lunchroom was not large enough
c) No secretarial facilities were available
d) The office space was not sufficient when the around-the-clock crews were all reporting on days.

For Consideration - An expansion project for the building was scoped, and is presented in "Alteration and Expansion of 2704-C Building, Project CA-693".

2707-C Building - Change house, instrument shop, electrical shop, and RMO office.

Status of Services - The building is completely winterized. All of the water and steam services are turned off at the external supply valves and all lines are drained. All electrical service is shut off at the building main.

Contents - The SWP lobby contains a few reusable sets of clothing for repeated entry into the Hot Shop. The instrument and electrical shop contents, as well as the radiation monitoring office equipment, remained at the time of this writing. All permanent sets of lockers remain in the change room.

Operating Experience - Generally, the building was adequate; however, the SWP lobby was quite crowded at change time. The distance between the lobby and the Hot Shop was objectionable since there is no shelter or heat between the two areas.

2715-C Building (Storage)

Status of Services - Steam and electricity are off.

Contents - General Storage.

215-C Building (Air and inert gas supply)

Status of Services - All services are still utilized. Building heat will be maintained above freezing.

Contents - Three compressors --Fuller Type C-25 (30 psig-127 cfm), Ingersoll-Rand Model 101-X (45 cfm at 125 psig), DeVilbiss (Model 330)(11 cfm at 125 psig)-- Electrodryer air drying unit, ozone generator, and two inert gas generators.

Operating Experience - All units operated satisfactorily; however, there was always a shortage of high pressure raw air when several sample jets were operated simultaneously.

The oil carry-over from the Fuller compressor was troublesome. It penetrated the drying beds and caused "gumming" of the "Flowrators" on the instrument air.

Status and Required Items - All units are operable; however, the Ingersoll-Rand compressor should be overhauled to increase its capacity before any extended operation of the plant is undertaken. The aluminum oxide drying media in the filter and the driers should also be changed.

For Consideration - An oil removal device should be installed on the Fuller compressor outlet to eliminate the oil carry-over into the driers.

217-C Building (Demineralizer)

Status of Services - All steam and water is turned off at the supply valves, and the electrical service is off at the building main. There is no heat in the building.

Contents - One Graver Demineralizing unit complete and one spare MSA Clean-Air Blower (MSAL-673-Fresh air pump).

Operating Experience - The unit was operated by the Power Department, and very little difficulty was encountered. The unit was adequate in every respect.

Status - All of the equipment is drained. Otherwise, it is ready to operate when the open flanges are reconnected.

For Consideration - Prolonged dryness of the exchange media may cause a deterioration; consequently, the resin beds may have to be replaced.

291-C Building (Fan House)

Status of Services - All services to the building are operating.

Contents - Steam turbine, with blower and electric motor with blower.

Operating Experience - Satisfactory performance was obtained throughout the duration of the Semiworks operations. The hydraulic speed control drive bearing and the electric motor bearings became rough and were replaced in early 1957. Some difficulty has been experienced with the adjustment of the vacuum on the dissolving system in 201-C. Setting of the steam to the stack jet (an air-operated valve in 291-C) was too sensitive.

Changes - The automatic turbine start-up switch was changed from a pneumatic sensing device to an electrical solenoid. Although the pneumatic device was quite satisfactory during normal operation, it would not allow the low differentials pressures desired during the non-operating status of the plant. The solenoid will start the turbine whenever there is a power outage to the electric motor.

A modified No. 1 spline was installed in the stack-jet steam control valve in place of a larger plug valve. Tests indicated that it should be satisfactory unless large process vessel leaks develop.

Status of Equipment - Operating.

276-C Building (Solvent treatment)

Status of Services - All water is shut off to the building, and all of the tanks are drained; however, the building will be heated to 50° F during the winter months. The air intake of the heating unit is covered and the inspection doors are left open for air recirculation. The first floor door, which opens into the stairway, is also left open for the same reason. All electrical service is off, except that to the stairway lights and the supervisory air pump (on the fire alarm system).

Operating Experience - The building was more than adequate for the needs of the Purex runs. It was only used for the addition of fresh solvent to 201-C or for the storage of used solvent.

Status of Equipment - All units are ready to operate, except A-27. A new shaft was installed in A-27, and the agitator has not been run in. (This now contains a labyrinth-type seal which requires an air purge.) Most of the equipment is still explosion proof. The only change required to make the building explosion proof again would be to reinstall the flame check and seal pot on Tk 26. The purge to A-27 should be converted to inert gas.

Required - Connect A-27 electrically and "break-in".

For Consideration - Tk-26 needs a pressure relief system other than through the crib.

241-CX Building and Vault (Waste Self-Concentrator)

Status of Services - All services are off. The electrical service is off at the building main; water is off at the underground supply valve; instrument air is off in the pipe trench beside 217-C.

Operating Experience - Changes and Improvements - A separate report by R. D. DeWitt covers the details of the concentrator operation. However, several mechanical difficulties are noted:

1. The vapor header heaters shorted and failed because of the collection of moisture in the ground and subsequent settling of the backfill. Calrods were then ordered and driven down beside the vapor header to supply the necessary heat.

2. There was apparently not enough slope on the vapor header and the condenser to prevent refluxing of condensate back into the tank. The major source of trouble was the piping configuration at the end of the condenser. Piping revision rectified the situation.

3. The condensate piping would air lock and prevent normal flow. This, also, was remedied by running a direct line to Tk-79.

4. The rotameter indications on the condensate flow were never very satisfactory. Original rotameters on the condensate flow continually stuck. A direct line from the condenser to tank-79 was installed with a Fisher and Porter rotameter.

5. Initially, a good indication of the pressure "bumps" was not available. Consequently, a strip chart recorder was installed which started and recorded the pressure surges whenever they occurred.

6. The steam generator, designed for steam sparging Tk-72, was not satisfactory during trial tests and was never used. Furthermore, there was no means of maintaining a liquid level in the pot, and the heating unit would not keep the pot dry.

7. To minimize the possibility of contamination spread in case of condenser water failure, a controller was installed on the condenser temperature which turned off the tank heating elements at a preset temperature. If the temperature became extremely high, the controller would automatically dump 50 gallons of water from a drum into Tk-72.

8. The dip tubes plugged continually (conductivity probes would have been more satisfactory). A humidifying pot was installed to temporarily alleviate the plugging, but was not entirely successful. None of the lower dip tubes are now operable.

9. The strength of stirring paddles (for "feeling" the sludge) was underdesigned. The bottom paddle sheared off and is now inoperable.

Status - Everything is shut down and winterized. The tank contents are cooling at the rate of 10°F per week. (The highest temperature reading in the tank on August 12, 1957, was 215°F.) All of the equipment was operable at the time of this writing. (The standard cells for the instruments are stored in the instrument cabinet in 271-C.)

271-C Building (Aqueous Make-up)

Status of Services - All water to the building is shut off at the external supply line. Steam to the heating unit will be in service during the winter months to provide a 50° F temperature and to prevent any of the building contents from freezing. The air intake to the heating unit is covered and the inspection ports are left open to allow recirculation of the building air. All internal doors of the building are also left open for the same purpose. Electrical service is on to only the heating units, a few building lights, and the alarm systems.

Contents - All of the chemicals have been removed; otherwise, the building contents remain intact. This includes all of the aqueous make-up and feed tanks with their associated piping, valves, pumps, and auxiliary equipment.

Operating Experience - The aqueous make-up facilities operated quite satisfactorily; however, the frequency of individual make-ups was high. Hence, capacities could be improved. The means of getting dry chemicals into the make-up tanks was also cumbersome.

Considerable trouble was experienced with the Allis-Chalmers centrifugal pumps. Leaking around threads and packing glands occurred. Some deterioration of the concrete floor resulted from these acid leaks.

Since there were no tank vents, the fumes in the building became quite obnoxious at times, and caused corrosion of the painted walls and other mild steel items.

Changes and Improvements (Operational)

1. An external acid pumping station was installed to permit the use of a trailer to transport acid into the plant.

2. A pressurization system was installed on the head tanks to provide greater flow capacity and better control of the column feed streams.

No major changes were made during the maintenance program.

Status of Equipment - All equipment in the building remains in an operable condition. All tanks and lines have been flushed and drained.

Required Items - Flange guards should be installed on process flanges.

For Consideration -

1. A tank vent system to protect personnel and equipment would be a great improvement.

2. Chemical storage space is small. An extension of the loading dock and an overhead roof would help this problem.

3. Capacities could be increased and the operating time reduced with the installation of some automatic or semi-automatic make-up devices on the demanding feed streams. (particularly HCX and ICX).

4. Tank-39 could use a heating jacket in preference to the existing steam sparge.

5. Better means for loading dry chemicals into the tanks could be developed.

6. The magnetic filter on Tk-68 needs repair or replacement. It has not proven satisfactory. An electrically induced magnetic field to separate the iron should be better. The current can be turned off and the excess material can be easily removed.

271-C Control Room

Status of Services - The steam, heat, water, and electrical services are as indicated in the aqueous make-up discussion. Instrument air is shut off to everything, except Tk-44 (sump) manometers and the 271-C heating unit.

Contents - All of the main process control and indicating instruments remain intact and ready for use. The inline instruments are only partially intact with several units having been removed to other facilities. (See the Appendix-Equipment Loan List).

Operating Experience Process Instruments - Most of the instruments worked satisfactorily; however, several gave poor control or were rather inaccurate. Rotameter indications were a problem because the calibration of the meter would shift over prolonged periods of time. Elaborate checks were used to demagnetize float armatures and adjust voltages. Many of the rotameter coils were rematched to the instrument by changing resistors. This rematching was quite successful, but did not fully remedy the "calibration shift" problem. (See a copy of an informal report on Foxboro dynalogs and Fisher and Porter rotameters by G. Seaman in Semiworks file).

Tank 64 (No. 1 acid concentrator) never operated successfully with automatic control. Foaming and pressure build-ups were serious and the instrumentation would not maintain complete control on the basis of either specific gravity or temperature measurements. Other concentrators operated reasonably well on temperature control, even with the small primary sensing range available. The dip tube, specific gravity type control, on the top interfaces of the columns worked fairly well. However, some error was imparted to the readings by the pulse frequency of the column, even though snubber coils were used on the sensing lines of the Republic transmitters. This error was never serious enough to impair operations. The capacitance probes worked very well for interface control. The instrument shorted out several times when the Teflon sheath ruptured. Failures of the pneumatic-electronic converter also occurred. Operation of Tk-81 vacuum control with the U-tube mercury manometer and relay was not successful because there was too much lag in the sensing system and the solenoid air bleed valve was too large. Also the indication of specific gravity and subsequent steam control to the vacuum acid fractionator was not successful. (Densitrol) (The sensing element was located on the reboiler effluent streams rather than directly in the down comer of the tube bundle. Also, the total pot holdup is believed too small for good control, since incremental changes in pot boil-up would probably have a pronounced effect on the pot concentration. This should be confirmed by tests and calculations.)

Repeated repair was necessary on the Panellit jet switches to prevent constant jetting or purging of the jets. Broken switch drives also required repair. None, other than expected routine maintenance, were required on the Control room side of the in-line instruments. This is further discussed under A, B, and C Sample Galleries.

Changes and Improvements -

1. Pressure-limiting switches were installed on Tk-64 and Tk-55 to shut off the coil steam when excessive tank pressure developed.

2. An automatic-recorder controller was installed on Tk-1 vacuum to give a continuous record of the vacuum.

A device was also installed to shut off the steam whenever the vacuum seriously decreased.

3. Dual rotameters were installed on the 10S stream to increase the capacity and range of the system.

4. Dual ranges were installed on the temperature controllers for better control.

5. Voltage meters were installed above the electrical board on the three phases of the 440-Volt supply to indicate when any of the phases became grounded by equipment shorts.

6. Pressure recorders were installed and connected to differential pressure cells on the HA and 1A columns. An acid leg was used to balance the static head of the column and to provide sensitivity. This system indicated the organic loading of the column quite well; but it was only relative in its readings and not absolute.

7. A Teletalk Communication system was installed for improved two-way communication between the cells, Hot Shop and the Control room.

8. A P-5 flow indicator was installed to indicate when P-5 was pumping. This was changed from a pressure transducer to a conductivity probe during the Maintenance Program. A push button still must be connected on the panel board. This will provide "demand" reading and prevent electrolysis of the probe by continuous operation.

9. A warning device was installed on the pneumatic converters of the capacitance probes. Whenever the converters fail, the pen will be driven full scale.

10. A small box with a cam-operated switch was made for control of the electrical supply to the sample jet-valves. This provided the cycling necessary when large volumes were taken from a sampler.

Status of Equipment - All of the manometers are out of service and the oil is drained on all except the sump manometer. All electrical service is off to the instruments, and the batteries have been removed. Otherwise, all instruments are ready for use, except for those in-line instruments which have been removed from the building. (See Appendix.)

Required Items - None known.

For Consideration -

1. A diaphragm pressure-indicating device would be better than a manometer on the concentrators. This would prevent contamination of the Control room from "blown" manometers.

2. Another control system on Tk-64 is necessary if the tank is not changed and foaming continues to be a problem.

201-C A-CELL

Status of Services - All steam, water, and electricity is off to the cell. Heat is provided by a stack-fan draft through the supply units in the air treatment room. (See Air Treatment discussion). Instrument air is provided to only the sump dip tubes.

Contents - All contents in the cell remain intact. This includes all of the tanks and affiliated piping, as well as all of the electrical, pump, and agitator units.

Operating Experience - As a whole, the cell and equipment performed fairly well. However, many mechanical details and failures were encountered during its operation. Major obstacles to operations were:

1. Teflon gaskets would deteriorate under the influence of heat and radiation. As the material would become brittle and split, many leaks were produced throughout the piping and tank systems. These leaks caused a major load on the concentration capacity. (Reconcentration of leaked solutions was necessary.) Also, jet transfers were difficult and some times impossible with the faulty gaskets in the lines.

2. A number of the temperature sensing devices failed and could not be used for control.

3. Tank-64 (No 1 acid concentrator) was troublesome throughout its operation. Foaming was evidently the source of trouble, and the tank design was not particularly tolerant of this situation. Continued pressure surges occurred during concentration.

4. Original Design - The philosophy of locating a large number of tanks and equipment within the same enclosure proved quite costly if the time required for decontamination was considered. Essentially, the entire cell had to be at least partially decontaminated before maintenance could progress. Thus, decontamination of equipment, which required no maintenance work whatsoever, was necessary before the desired item could be repaired.

5. Tank and concentration capacities limited the rate of decontamination.

6. Strictly manual manipulation of sprays and hose was required to decontaminate equipment externals.

7. The Amercoat paint on the concrete floor did not withstand repeated exposure to process leaks. Deterioration and contamination of the concrete resulted. Decontamination was extremely difficult!! The slope of the cell floor was not steep enough for rapid run-off of solutions.

8. Chempump failures occurred repeatedly and the remote pump jumpers did not change easily.

9. The centrifuge failed (bearings).

10. There was no scaffolding in the cell and the irregular system of piping made equipment hard to maintain. Much time was lost in providing a means for personnel to reach the desired location.

11. Removal of equipment from the cell was difficult. The cover blocks cover only about one-third of the cell ceiling area. Thus, overhead access to equipment was very poor. Mechanical items, which must be removed, generally were not located under the cover blocks where a crane could be used.

12. The paint on steel equipment did not stand up. Such items as electrical conduit boxes, agitators and valves were sources of high radiation readings. The Shell Chemical Company's Epon 328 was the most satisfactory. Pitting occurred, but there was no peeling of the material. It also seemed to decontaminate easier.

14. The sump invariably became full of sand and miscellaneous material. There was no method for removing this "hot" material, except by manual labor.

15. Two jet discharge lines were severely corroded (55 to 69 and 64 to 69). Sections of the pipe were eaten away to produce a severe leak. Samples were sent to the laboratory, and all Huey tests indicated 0.0006 to 0.001 ipm for the corrosion rate. Reasons for these pipe failures are unknown. Boiling of the contents in the jet dip leg with refluxing is suspected.

Capacities were, in general, adequate for the processing rates used. However, concentrators were always limiting during decontamination periods because of the large volume of flushes which must be handled. The quicker the solutions can be handled, the sooner the job can be completed. (The proposed tube bundle for Tk-55 and the changes on E-55 discussed later should help alleviate this problem.)

The dissolver capacity should achieve the continuous processing rate of 610 pounds of uranium per day. In general, during previous runs approximately 1275 pounds of uranium could be processed with three dissolver cuts in 52 hours or 590 lbs/day could be processed. (8 hrs to charge + 44 hours for the jacket removal and 3 dissolver cuts.)

All other equipment in A-cell has the capacity for a 610 lb of uranium per day processing rate except Tk-64. Foaming may reduce its capacity. (Actual production capacity tests were never made, but the cell equipment operated smoothly at 430 pounds of uranium/day.) See the Appendix for concentrator capacity tests on water.

Changes and Improvements (Operational)

1. A manual activator was installed on the F-5 filter system to turn on another off-gas filter when the one in service became inoperable.

2. Miscellaneous piping modifications and repairs were made.

3. A flow indicator was installed on P-5 (scrubber recirculation pump).

4. A special decontamination box was fabricated for the pump jumpers and installed in A-courtyard. (Jumpers were removed from the cell and set into the box for further decontamination. This box was equipped to route solutions inside and outside of the jumper. Jumpers were then repaired.)

5. When the electrical heads on the pump jumpers failed, a two-inch hole was drilled in one of the cover blocks and a drop cord was installed to supply power to the pump on the jumper. (This is no longer used.)

6. The pump priming devices failed; so a new jumper was installed with a bleed-off valve on the jumper for priming. Instrument air was supplied through a rubber hose. (No longer used.)

Maintenance Program - Note: These items have not been exposed to full operating conditions and should receive special consideration before start-up of the plant.

1. Nearly all of the Teflon gaskets in the cell were replaced with Teflon-Flexitallic. These were chosen because of their better service at other sites and because the stainless steel spiral should provide support for any deteriorated and cracked Teflon; thereby, it should prevent the gaskets from blowing apart and leaking. If leaks occur, they should be smaller than those which occur with blown gaskets.

2. All of the jets in A-cell were changed to a plant fabricated "tee", jet, except J-44 to Tk-26 which is a special high head jet. (Now in service for the sump jet to the crib.) Most of the lines connecting the jets were welded. All suctions, steam supply lines (at the ceiling and down to the jet), and discharge lines were welded. Some flanges remain on the discharge lines where they enter another tank.

3. All-welded lines were installed on 10 samplers (Tk-69, Tk-7, HAW, 2AW, Tk-73, Tk-6, Tk-3, Tk-55, Tk-64) to reduce leaks and assure samples at these points. This eliminated many of the Koncentric fittings, which invariably developed leaks.

4. The agitators on Tk-69, Tk-7, and Tk-6 were repaired. Failures were caused by bearings and bent shafts. Shafts may not have been properly stabilized, and whipping may have resulted.

5. G-6 centrifuge was repaired. New upper and lower bearings were installed. The broken centrifuge oil feed ring was replaced. (This could have been the cause of the bearing failure since little oil would be circulated to the upper bearing. At some earlier date, the old one had been repaired by brazing.) Since the plow had not been used, it was removed and a bowl spray was installed in its place. Thus, ready removal of the spray could be made at any time. A decontamination spray ring was added to the side of each

nozzle. This was connected with the low-pressure dip-tube line of the centrifuge weight factor. In the event that the nozzles are again a source of radiation, they may be flushed by pumping solutions down the dip tube line. A new oil addition ring assembly was made up in an attempt to provide a means of preventing flush solutions from entering the oiling system. A completely covered ring was used. (This ring is necessary to allow freedom for the bearing housing since it is mounted in rubber alone.) All steel parts of the unit were painted with Epon 828.

6. The old E-5-4 off-gas heater was removed, since frequent plugging had occurred and a new larger unit with an internal spray line for flushing was added. The drain valve of the off-gas header was removed from Tk-5. (Dilution of the scrubber caustic always occurred from the E#5-4 flushes .) The drain was tied into the tank overflow header which drains to the sump.

7. Lead slabs (1/4"x2'x2') were placed over many "hot" spots on A-cell floor. A concrete mix was then poured over the entire floor. Depth of the pour varied from two inches near the sump to five inches at the corners of the cell. Two types of mix were used. A lead shot mix was placed in the middle one-third of A-cell. Magnitite mix was used on the remaining portions of the floor area. Volumes were -- Shot mix -- 1.2 of cement, 1 of magnitite gravel, 2 of lead shot (1/16" dia.) and 1 of water; magnitite mix - 1 of cement, 3.5 of magnitite gravel and 1 of water.

8. A type 304-L stainless steel floor (3/16" thick) was installed over the new concrete as per Sk 2-50155. The floor was entirely sealed by welding to the tank legs. Cinch anchors were used to fasten the stainless steel to a chipped groove about 14 inches above the floor. The groove was filled with Ceilcrete and painted with Epon 828; then an overlay of Thiokol was applied. Thiokol with EC108 activator is a Minnesota Mining Company product, which sets to a rubber-like consistency. (It is not acid resistant, whereas Ceilcrete is.) This should allow some give and still retain a seal. The floor-to-wall seal was protected by a secondary seal, an overhanging skirt which was bolted to a groove above the floor seal. Concrete, Ceilcrete, and Thiokol were used to seal the top side of the skirt. The overhanging skirt is not firmly attached to the floor. Although clearance is available between the skirt and floor, attempts have been made to design the skirt so that the amount of liquid which could splash up under the skirt would be minimized.

The floor was tested by applying air below the floor at 4-1/2 inches of water pressure. Soap solution was then used to locate leaks. Drums of water were set at strategic stress points during the test.

9. A new jet was installed to transfer the sump directly into Tk-69. This was done to alleviate the necessity of jetting into Tank-55 while it is operating. Sometimes part of Tk-55 contents must be transferred to Tk-69 when sump jetting is required.

10. The F-5 actuator valve was overhauled and the supply line rerouted. The unit was painted with Epon 828.

11. The pump pan for the remote jumpers was completely overhauled. The nozzles were reset with consitent dimensions and close tolerances. (Much trouble had been encountered in the past because the jumpers would not fit the

nozzles properly.) The pan and nozzles were reinforced. The bottom drains that had plugged during the Purex operations were removed and a jet was installed to transfer any pan contents to the sump. A weight factor tube was installed which would immediately indicate any jumper leaks. The pan was located in an east-west direction, instead of a north-south direction to increase overhead visibility. It was then welded to the stainless steel floor and supported to the walls. The discharge piping was revised to aid pump priming (an air trap occurs in the pump jumpers and priming is difficult). The size of P-7 discharge line to the helix was increased to one inch. Thus, more pump head should be available. The pump jumpers were completely rebuilt by using the pan as a jig. The kick plates were situated such that the dogs would not impart a strain on the short jumper when the connectors were loosened. A mock-up jig was constructed for use in fabrication of future units. The electrical jumpers were wired on the 2, 4, 6 poles. Spare wires were run from the pipeway to the 1, 3, 5 poles. Thus, if the leads on a connector became bad, a jumper may be rewired to the unshorted poles and set in place.

New all stainless steel Chempumps (internally and externally) were used. The outside can was welded to the pump-housing retaining-flange and the stator was air tested for leaks.

12. The original P-5 flow indicator instrument was converted to a conductivity device. The transducer on the old unit had apparently leaked and shorted. The conductivity probe was made from a Koncentric fitting with a Teflon insert to protect the sensing wire. It was installed in the vertical position to assure drainage. A push button was mounted on the panel board to activate the unit. When it is desired to determine if the pump is pumping, the operator can depress the button and observe the galvanometer deflection. The button was used to minimize the amount of DC flow and its resulting electrolysis and deterioration of the probe.

13. The jet discharge loops on Tank-69 header were raised to eliminate blowback from one jet line into another.

14. All of the high pressure steam lines to the concentrators were welded at all points up to and including the trap inlet. The lines are still flanged from the trap outlet to the pond or crib header. Check valves were installed downstream of the traps on Tk-1, Tk-55, Tk-64, and Tk-73 to permit operation of the pond or crib headers even if the coils in these tanks fail.

15. The specific gravity dip tube range was changed from five to ten inches on Tk-1. This dip tube spread of ten inches should give greater stability and reliability to the reading. A No. 2 oil was then used in the manometer.

16. The E-64 condensate temperature element was moved from its location in the drain pipe above Tk-73 to the sample hold-up pot. This move was made because E-64 temperature would always indicate when Tk-73 was boiling. The back surge of steam in the dip tube of Tk-73 apparently caused this.

17. Spare temperature wells and elements were added to Tk-64 and Tk-73. The leads were run to the pipeway only. This will allow an alternate unit for operation of the concentrators when the element in service fails.

18. A large wire screen (made from welding rod) was set inside of the top exit nozzle of Tower 55. This was to prevent future blow over of the tower packing. (When E-55 was dismantled, the vapor header was half full of 1-inch raschig rings.)

19. E-55 vent line was moved from the end of the condenser cap to the top. Also E-55 drain line was changed from 1/2-inch pipe to 1-inch pipe. This seemed to alleviate the problems encountered with the capacity limitations on Tk-55. (Before, the condensate would run to the sump whenever the capacity reached somewhere around 4 liters a minute. Liquid was apparently running out of the end vent line because there was insufficient head available to carry the liquid through the 1/2-inch pipe.)

20. Tank-55 coil was tested and found leaking in two places. After the hydrostatic test indicated a leak, 90 psig air pressure was applied to the coil with the tank full of water. The coil was visually checked through the agitator nozzle. Leaks occurred along the north side of the coil and along the west side. Only the bubbles were seen and the physical appearance of the locality of the leak was not observed. Both leaks are small. A new remote assembly was designed (not fabricated) to provide a tube bundle which would be attached to the outside of the present tank.

Design is such that it could be changed by a crane without a decontamination of A-cell. See H-2-4476 - Sheets 1, 2, and 3.

21. Tank-64, Tk-1 and Tk-73 coils were tested and found to be satisfactory. The outside diameters of the coils on Tks-73 and 64 were measured. Approximately a 35-mil surface depth had corroded away.

22. New raschig rings were placed in the bottom section of the Tower on Tk-64. These were all fabricated from corrosion passed, seamless, 3/4-inch pipe which was cut into 1-inch lengths. The 16-gage raschig rings which were removed from the tower were badly corroded and pitted. Some rings were almost totally destroyed by corrosive action. Samples of the rings were sent to the Corrosion Laboratories for analysis. They reported 0.0031 and 0.0064 ipm as the corrosion rate by a Huey test.

The tower on Tk-64 was previously packed with both 1-inch and 1/2-inch raschig rings. The top four feet of the tower contained the 1/2-inch rings which were dumped on top of the 1-inch rings without any packing support or separator. The 1/2-inch rings were corroded; but not so severely as the 1-inch rings. Their corrosion was primarily end-grain attack. These 1/2-inch rings had passed a Huey corrosion test before they were placed in the tower.

The size of the bottom packing support was reduced to fit inside of the 10-inch tower. (Originally a flange-spacing disc with perforated holes.) This was raised 18 inches above its old location to give more freeboard in the tank. It was suspended by three stilt rods which were welded to support blocks placed inside of the tower. A grid of vertical 1-inch (3/4-inch pipe) blocks placed on top of the perforated support plate to provide better free area through the packing support. A new packing support for the 1/2-inch rings at the top of the tower was fabricated from 3/4-inch pipe rings by welding them together and placing support bars across the assembly. It was supported by welding small rods to the tower wall.

The spray and chemical addition line was removed from the middle section of the tower and and a new spray nozzle was added at the top of the tower. This gives a means of flushing the entire tower. An all-welded assembly was used for the nozzle. (A Spray System Co. GG16.)

23. The raschig rings were removed from T-73. Corrosion was so severe in the bottom section of the tower that the rings occupied less than 1/3 of their original volume. Many had been reduced to small fragments by the corrosion and some of these were found in the tank instead of the tower. Since the bottom packing support was corroded more severely than the top one, positions were exchanged. Additional crossbars were welded across the tower to prevent any future "fall through" of the packing support. A 14-inch O.D. grid composed of vertical 3/4-inch corrosion-passed pipe rings was placed on top of both packing supports. The bottom section of the tower was loaded with a 6-inch depth of the pipe rings and the remainder of the tower was filled with standard 16 g. 1-inch raschig rings, which had an average corrosion (Huey) test of 0.0015 ipm. Spray nozzles in the top of the tower were corroded away. Some of these were cut off and capped. Others were replaced with a Spray Systems Co. GG16 nozzle.

24. The bar-type dip tube support in the sump was removed and the dip tubes were changed to pipe instead of tubing. A support ring was welded to the side of the sump and the dip tubes were inserted through the ring.

25. Tank-55 header from C-cell was vented at helix No. 1 in A-cell to the Vent header. This sould alleviate some of the blow back problems encountered in C-cell.

26. P-6 was removed to 241-CX area. This was a Hanford designed and fabricated pump. It never proved satisfactory because of rapid bearing wear, priming difficulties, and loss of head. It was inoperable throughout the Purex runs. When the unit was dismantled, the Boron carbide bearings were found to be cracked. The unit was replaced with a simple air lift and transfer jet which may be used as an alternate feed system to G-6 when the regular air lift unit fails. Maximum delivery of the system on water is 1.2 liters per minute.

27. Both AOV-64 and AOV-73-2 were removed and replaced by separate air lift transfer devices. (In the past, the valve flanges had caused serious leaks and were a source of high radiation during decontamination.) These air lifts were installed to provide a controlled flow transfer with an all-welded piping system. The system is arranged so that the tanks overflow into the air lift leg; thus, the liquid level of the tank may be maintained at the overflow level if desired. The air lift will transfer everything which overflows. If the overflow system is not desired, the liquid level may be maintained anywhere above the overflow point by controlling the air flow to the lift. The lifts have an operating range of 300 ml/to 1000 ml/min with a flow of 2 to 74 cfh. (A special steel ball was inserted in the flowrators to give higher air capacities.) This is a higher rate than required for existing flow sheets; however, the rate may be reduced by an intermittent operating device. (i.e., electrically-driven cam-operated switch and valve.)

30. The overflow from G-6 was revised. The AOV was lowered about 6 inches to provide more operating head. The outlets between Tank-6 and Tank-3 were interchanged. In the event of an instrument air failure to the valve the flow will be to Tank-3. The Tank-3 line and the Tank-6 line were vented to prevent slugging and irregular flow into the dip legs of the tanks.

31. Seal pots were installed on the discharge of Tk-3 and Tk-55 samplers to prevent blow back into the sample gallery when the concentrators are operating.

32. All of the steam traps in the cell were overhauled. Many were found bad. The common failure occurred in the float of the Yarway impulse-type traps. Over 50 percent of the traps in the cell were not functioning properly. The control disc on the top of the float in several cases was dislodged from the float. Poor fabrication or solder was the apparent cause. The float tail was worn or completely gone on other traps.

33. A permanent lighting system was installed in the cell. This consisted of fourteen vapor-proof lights. The globe assemblies were painted with Epon 828 and bolted to the cell Unistruts about three feet from the ceiling.

34. A new intercommunication system was installed with two master stations, control room and Hot Shop. The installation aided the communication between personnel at its stations. Sounding monitoring in the cell will be a great operating aid as well. (a microphone was installed in A-cell. C-cell microphone has not been installed.)

35. The cell spray headers were cut and a twisted spiral stainless steel strip was inserted in each. This change was made to provide distribution of the decontamination liquid to each of the cell sprays when steam motivation is used for distributing chemical decontaminating mixtures. This system was tested with steam and water and was found to operate best at 10 to 40 psig steam when 8 gpm of water was used. Distribution was fairly good, but the nozzles were far too low in the cell to give good coverage.

36. The ventilation louvers were repaired and the linkages were checked to each for all three cells.

Status of Equipment

1. All gaskets in A-cell are now Teflon Flexitallic, except E-1-1 Top; E-1-2 Top, and numerous vent lines.

2. All agitators are in an operating condition; however, A-73 should be removed to replace the air purge labyrinth-type seal. This was leaking steam on the last boil-up test in Tk-73. The maximum air purge capacity of the flowrator was not sufficient to stop the leak.

3. Tank-55 coil is leaking and the tank will need a new heating unit. A remote tube bundle assembly is drawn on SK-H-2-4476 Sh. 1, 2, 3.

4. All of the transfer jets are welded, except J44-1 (to crib) and the Connector pan jet.

5. Only the Tk-69, Tk-7, HAW, 2AW, Tk-73, Tk-6, Tk-3, Tk-55, and Tk-64 samplers are welded.

6. The new agitator for Tk-55 is stored in 271-C. Presently a recirculating 20 gpm jet has been inserted in the tank to provide agitation.

7. All of the equipment is operable. This was shown by operating test at the time of shut-down. All jets, tanks, condensers, jackets, coils, mechanical equipment and lines were operated and leaks checked.

8. Cleaning and painting of exposed steel equipment with Epon 828 is not complete. Mostly, conduit boxes remain unpainted.

9. The painting on the walls of A-cell is badly cracked. Wherever these cracks exist the concrete has been deteriorated from acid attack and, of course, each crack contains considerable contamination. These cracks exist in an irregular cross-hatch pattern, with about a three-foot spacing.

10. The piping is not supported or hung in many places, but is only installed.

11. The cell is not explosion-proof. An estimate was made in 1956 that it would cost $23,000 without contingencies to explosion-proof the cell. (See the folder in the Semiworks file for the details.)

12. Common entry nozzles were tested to determine whether they would blow back and cross contaminate the system. The worst potential (dip leg on the nozzle and low entry elevation) was tested. There was no evidence of blow back.

13. Both P-5 and P-7 were primed with water, but this should be checked again with the process solution specific gravities.

Required Items

1. Repair A-73 seal
2. Install new tube bundle on Tk-55
3. Repair and paint the cracks on A-cell wall. These should be scraped, cleaned, plastered, and painted.
4. Hang the piping in A-cell
5. Remove the scaffolding
6. Clean and paint the remainder of the steel items, particularly the conduit boxes.
7. A-55 should be inspected to determine whether the bearing mount is separated from the support flange. If not, the bearing should be raised to allow a free air space between the flange and the bearing. A slinger ring should be installed just below the bearing. All of this is necessary to prevent the vapors that leak past the seal from ruining the bearing.
8. Connect the sump jet to organic crib instead of to Crib-216
9. Clean tank surfaces to remove splattered concrete
10. Clean the sump

For Consideration

1. The remainder of the flanged piping in A-cell could be welded. The following are particularly important:

a) Jet discharge lines into vessels
b) Steam and water lines
c) Other process solution lines

2. The remainder of the gaskets in A-cell could be replaced. (See Equipment Status, Item 1).

3. A new No. 1 acid concentrator and tower of different design could be installed. This should be of an all-welded construction, should have a larger freeboard space, and should have provision for replacement of the coils or tube bundle.

Dip legs on the tank should be external to the tank and enter on the sides or bottom of the vessel. (This prevents boiling of the contents in a dip leg.) All parts should be stainless steel or other non-corrosive material, with no steel parts. It should not have an agitator (mechanical), but a sparger if desired. No flanges should exist on any portion of the tank. All assemblies are to be broken or made by use of the electric arc.

4. A separate waste or feed hold-up tank which is external to the existing cells would permit the storage of rework material or feed while maintenance is being conducted in the cells. Presently, there is no place to put highly radioactive material that is in the plant system while maintenance is performed in A-cell. Sometimes this maintenance is essential before operations can continue. C-cell is not very satisfactory for storage because of the bottom outlets on the tanks. (A gasket leak developed during a previous storage of feed in the cell. Loss of the feed and general floor contamination resulted.) Any storage in C-cell also subjects the gaskets to additional radiation and reduces their life expectancy. It also means some additional decontamination in C-cell.

5. As long as feed clarification is deemed a required step in processing, the centrifuge in A-cell is a critical item. Its failure means costly and time consuming plant shut down. The location of the unit is such that a full decontamination of the cell is required before maintenance can be initiated. Also its physical location makes maintenance difficult, since there is no overhead opening for crane access. Consequently, tackles and hoists must be placed in the cell for careful manipulation of the unit during assembly and disassembly. This personnel exposure time is costly and deters quick completion of the repair. Therefore, an individual vault or cell enclosure is needed for the centrifuge. With an individual unit, decontamination and repair could be completed in a very short time as compared to the present installation. The vault could be built as a new individual unit outside of the cell with a separate cover block and stainless steel clad walls. Spray nozzles could be permanently installed for decontamination as well as the other necessary auxiliaries. Hence, a costly remote centrifuge would not be required. (There is no place to work on "hot" equipment which is removed from the cell unless some of the cells are decontaminated. Thus, even a remote unit

would need some type of construction external to the present facility.) The design of a contact maintained unit would permit utilization of spare centrifuge units now available at the Semiworks.

6. If an additional cell expansion were made to contain the extremely "hot" tanks, it could include all of the newest innovations for a contact-maintained plant. Containment of critical "hot" tanks would reduce the activity level in A-cell. Thus, A-cell could be more easily maintained and the new facility could be more quickly decontaminated and maintained as well because of its concepts in tank design, individual unit cell construction, and all stainless equipment. This new cell unit should incorporate most of the ideas discussed under Design Guides For a Contact Maintained Plant.

7. Large numbers should be inscribed on connections and equipment to identify helices, nozzles, and tanks. Personnel, particularly service crafts, which are unfamiliar with equipment, have difficulty following directions. Identifications on the system would reduce the exposure of the operating personnel and the amount of job directing required.

8. An interlock scheme is needed to prevent the closing of A-cell pond header valve when there is any possibility of the high pressure water being on or leaking through the valves in the valve room. Pressurization of the tank jackets in excess of 20 psig would cause disastrous ruptures.

9. A system to transfer large quantities of "hot" material into transportable containers is needed. Quantities are often required for studies at other sites. Also, receiving facilities are needed for material from other sites. This could encompass an underground piping system or a trailer transport scheme. Thus, future customer requests and studies could be conducted, since the facilities would then be available to permit a study of a particular plant feed, waste, or product solution.

10. Cut-out controls could be installed on the agitators to prevent them from being operated while the tank is empty.

11. The hose on the G-6 skimmer were removed. Replacements were not available, so the lines were fastened solidly to the skimmer. Vibration could cause a problem.

12. Koncentric fittings have a "habit" of becoming loose from vibration because of the torque imparted to the nut from the twisting of the tubing while the nut is tightened. Many more of the critical connections should be all-welded or the Koncentric nuts should at least be spot (tack) welded to the female body.

13. If a large leak develops in any part of the pond header, the operation of the cell must be discontinued because of the vast quantities of water involved. Installation of a few more check valves should be considered to prevent any back flow from the pond header into a leaking section.

14. The installation of a continuous dissolver to provide greater capacity or an alternative dissolution system for new fuel designs should be considered.

15. If the air purge fails on J-44 to Tk-55, the entire contents of Tk-55 would be drained back to the sump. This line should be vented.

16. An alarm device should be installed on the sump.

17. Installation of more radiation detection devices would greatly aid processing and be highly beneficial to cell decontamination.

18. The cell sprays should be raised to give better coverage of the piping system. At present, they cover only the tank tops. Testing and improvement of the steam motivation system should be pursued. Additional full-coverage sprays might prove quite desirable.

19. Evaluation should be given to internal tank spray. Particularly, if larger tanks are installed in the cell. With internal tank sprays, smaller volumes of decontaminating solutions are required. These sprays could produce savings in labor, chemicals, waste storage, and plant-down time.

20. A shielding slab should be designed to cover A-cell sump. This is currently the highest gamma exposure in the cell ("hot" material seeped behind the stainless sump liner before the stainless floor was installed.) The sump is always a high source in the cell from the material it collects. Removable shielding would be justified alone on the savings in personnel exposure.

21. A-cell floor was air tested at only 4-1/2 inches of water pressure because of the stress developed. A continual air purge could be placed under the floor as an additional safety factor against under-the-floor-contamination.

22. Additional assurance against vapor leaks from the concentrators could be obtained by installing a vacuum system to each condenser. Only a few inches of water vacuum would ensure that vapors would not issue from leaky gaskets.

23. If P-7 priming jet could be eliminated, the potential of feed being forced into the sample gallery would be removed. (The discharge of the jet would have to plug the check valve leak and the sample gallery gasket leak before this could occur.)

24. G-6 air lift was suspected for causing the radiation build up of the stack filter to 30 m rads at the surface (now decayed off). This was not conclusive. If so, the alternate air jet system for G-6 feed would have the same potential.

25. If the entry and exit lines into a concentrator were all raised, the towers could be flooded during decontamination.

26. E-1-1 and E-1-2 raschig rings have not been inspected. This should be done. The gaskets could also be changed to Teflon flexitallic.

27. The tower on Tk-5 could be changed to provide a de-entrainment section above the caustic feed point. This would eliminate some of the caustic carry-over into the condensers.

28. A-cell air sampler line should be moved near the exhaust duct to obtain a more representative sample.

29. The pressure drop in Tk-64 was still high (9 to 21 inches) when tested. The 1/2-inch rings in the top section should probably be replaced by 3/4-inch or 1-inch rings if the tower is used.

30. A valve room roof needs a rain gutter to keep water from pouring into A-cell when the cover blocks are off.

201-C - B-CELL

Status of Services - All water, steam, electricity, and air services are off to the cell. The cell is being heated as described under the air treatment discussion.

Contents - The cell contains all of the Purex solvent extraction contactors. This includes the HA, 1C, 1A, 1BX, 1BS, 1C, 2A, 2B, 10 and 1F columns, and all of their associated equipment. (Pulsers, valves, rotameters, service lines, and acid fractionator, its receiver and storage tank, the product load out facility, and a Hi-lift.)

Operating Experience - The equipment in the cell was not reliable for prolonged operation. Several things caused trouble. The principal deterrant was the Teflon bellows used in the pulse assemblies. Repeated ruptures occurred and subsequent shut down was necessary. Various bellows types and designs were tried with little success. Consequently, at the t ime the Maintenance Program started, substitution of graphite pistons for the Teflon bellows assemblies was initiated. The pulse drive mechanisms proved fairly satisfactory. However, they consistently provided a non-sinusoidal pulse. (Remote amplitude variation of the units is probably not required since this could be changed between runs or at the time of a shut down.) Several bearings were replaced as well as a pilot valve and rocker arms. The rocker arms fractured at the fulcrum connection. Disconnection of the entire pulse mechanism was cumbersome and time consuming. None of the external parts were interchangeable; consequently, no spare units could be made ready for installation. A cam-operated pulse drive with a hydraulic motor was also used in several locations. It operated satisfactorily, but no significant change in column operating characteristics was noted with its sinusoidal pulse wave.

The Hammel Dahl valves operated quite well. A few leaks developed around the bonnet nuts and some repair was required. Galling of the threaded stainless steel parts was troublesome during maintenance. Only one or two bellows failures occurred; nevertheless, the valves were a major source of radiation in the cell. The principal cause of this seems to be the non-flushable feature of the bellows stem. (The bellows forms a trap over the stem.) Later Hammel Dahl designs have reversed the stem mounting to expose only the external portion of the bellows to the process solutions. This external portion is easier to flush than the internal trapped area. Amercoat paint on the valves did not withstand the service and was, also, a contamination source. The control and tight shut-off features of the valves were very good; however, when the valves were dismantled, severe spline corrosion was noted. The corrosion attacked the filler metal weld between the stellite spline and the stainless retaining thread section. This was so severe that many of the splines had to be replaced.

The rotameters (Fisher and Porter) were a problem. Three troubles were encountered. The most serious was shorting of the rotameter coils. This was apparently caused from moisture in the conduit lines. Where this moisture came from remains unknown and many times presence of moisture was not evident in the conduit box. Some leads could be repaired by removing the sealing material and drying out the rotameter. The frequency of replacing the rotameters was such that repair of the old units was undertaken. Several of the units were cut next to the flange and the coils were removed. They were then either repaired or new coils were installed. Cost of the repaired units was much lower than the purchase price of a new rotameter. (Only complete rotameters were stocked in Spare Parts. Spare coils should be stocked in the future if it is not desired to repair the units on plant. Even replacement coil prices are quite high. Enclosed coils could be constructed on the plant probably cheaper than the manufacturers quoted prices.)

Frequently the rotameter bobs stuck and were difficult to free. Dirt particles and non-plumb assemblies in the cell caused this sticking. Also, the "tails" of the bobs became bent. This was believed to have been caused by high velocity imparted to the bob when sudden flow was started through the unit. Other bent bobs could be attributed to poor assembly and handling. Most of this bob trouble, however, occurred on the units that contained a center disc stop assembly (sometimes referred to as the float guide). In most of these, the "tail" was not rugged enough and became bent quite easily. Generally, this problem occurred on only the smaller flow rotameters.

The column design was quite satisfactory. Changing of the column cartridges was made without much difficulty. However, since the support rod nuts protruded beyond the flange faces a section of a column could not be removed without first raising another section considerably. Redesign of the spider plate would remedy this.

The HAF filter system was not satisfactory on uncentrifuged feed. The silicon Carbide Ceramic-type filters (consisting of four 3 by 3-inch cylindrical cups which would pass 30 micron material) plugged after about two hours of operation at 0.350 liters per minute. The water back flush system would never quite achieve the flow of new filters (as indicated by the pressure and flow of water through the unit). Repetitive plug-up of the filters occurred; thus, they were never used extensively.

The product was loaded out into standard Redox PR cans by a vacuum transfer from Tk-19. Very little difficulty was experienced, although careful handling was required. The plant had to be shut down in order to load out the product; otherwise, the radioactivity levels were too high for work in B-cell.

B-cell floor was a continual source of contamination problems. Since most of the maintenance work had to be done on the floor, it received severe abuse. Paint came off and was badly chipped. The hi-lift manipulation also aided this deterioration.

Capacity tests were never made on the columns, but performance at 430 pounds of uranium per day indicated that a 610-pound per day rate could probably be achieved on all of the columns, except the 1BS, 2A and 2B. The 1BS always showed flooding problems. Further tests or study would be necessary to confirm this.

Changes and Improvements

Operational

1. Extended the scrub section on the HA and IA colums to provide better decontamination.

2. Installed a capacitance probe interface control on the HC, 1C, 10, and 2A columns to obtain reliable control.

3. Installed larger vents on some of the columns to alleviate pulse pressure effects on the column dip tube signals.

4. Installed overflow pots in the overflow rotameter lines to improve the extremely erratic flow indications.

5. Installed the 1AP coalescer and filter to presumably reduce the entrainment from the 1A column.

6. Installed the HAF filter system to provide filtration of the uncentrifuged HAF because the feed centrifuge (G-6) had failed.

7. Installed the differential pressure cells on the 1A and HA columns to indicate organic loading.

8. Installed HCX, 1CX, HCP, 1BXF, 1BS, 1BP and 1CU temperature elements to permit high temperature operation of the cell and equipment.

9. Installed a 1AF to HAF routing to permit uranium saturation of the column on cold start-ups and to recycle the feed.

10. Removed the column pulser nozzles and changed many several times for the different bellows assemblies and pulsers.

11. Installed the 1F column to provide an additional organic wash system.

12. Raised the 1BS column to conform with Purex design.

13. Installed a decanter to remove the organic from the HCP stream before it reached the concentrator.

14. Installed decanter pots on the in-line sample lines to separate the aqueous and organic and provide a 100 percent organic sample.

Changes and Improvements

Maintenance Program

1. All of the Hammel Dahl valves in B-cell were overhauled. Diaphragms, bellows, splines, and gaskets were replaced where required. Valve travel and operation were checked.

2. All of the rotameters in B-cell were rematched to the recorders and the bridge and voltages were adjusted to give maximum scale indication on the control room charts.

3. Installed a 1FW sampler and a 1AP sampler (located after the 1AP filter). (Actual worth of the filter was never determined because a sample could not be taken.)

4. A line from Tk-75 to Tk-55 was installed.

5. A capitance probe was installed in the bottom of the IA column to provide bottom interface control.

6. Fabricated and installed a new unidiameter HA column and new cartridge.

7. Installed a portable stainless steel shower stall for the decontamination of equipment.

8. Repiped and revised the 1A and HA d-p cells to eliminate line traps.

9. Revised the 2A, 1BS and 2B column pulse legs to fit the new piston pulse assemblies.

10 Replaced all of the bellows-type pulse assemblies with new piston assemblies which had packing seals and an air purge suppression of the shaft leakage. All are new graphite assemblies, except the 1BS, which is Polypencol plastic. Seal leakage indicators and pots for the HC, 1C, 1A, HA, 10 and 1BX column pulsers were installed.

Status of Equipment

All equipment is ready to operate. However, only functional testing was made. Some of the rotameters remain stuck and need further checking. Rotameters, in general, need recalibration in order to obtain any accuracy.

Required Items

1. Complete operational testing with cold materials. This should include all flows, instruments, pulsers, etc., for proper operation, as well as leaks.

2. Recalibration of rotameters.

3. Recheck or calibration of the pulser transducers to the scope.

4. Check pulser piston seals and their air pressure requirements.

5. Repair B-cell floor. All of the old paint should be removed with solvent or sand blasting and a new paint job applied. The material used for another paint job should be acid and solvent resistant and capable of withstanding rugged use.

6. Clean and paint the valves with Epon.

7. Check out the 1A capacitance probe.

8. Replace the shielding on the HA column (stored in SW corner of B-Cell)

9. Replace the 1BS bellows which has operated 800,000 cycles on test without an air purge. Indications are that the bellows is full of water but there has been no leak. (Apparently leakage past the piston into the bellows is not serious)

10. Check out the differential pressure cells on the HA and 1A columns.

11. The 2A bellows chamber leaks and needs repair.

12. The pulser leakage pots need to be checked out for instrument air and solution leaks,as well as correct connections.

For Consideration

1. Removal or revision of the HAF filter system. If the system is used as it now stands there is a potential means by which the HA column contents could be transferred to the "Hot" Shop. Perhaps more interlocking devices would add to the safety of the installation.

2. Installation of rotameter knockers on the critical rotameters. Many times a rotameter becomes stuck and a small vibration will loosen it. Commercial air-type knockers or vibrators would probably be good.

3. Removal of the polypencc piston from the 1BS pulser. These have not been too satisfactory, since they expand with temperature. Also, there has been no "hot" operating experience with the unit. There has been with graphite pistons, although the types of seals are new.

4. Replacement of the 1AP filter or removal of both it and the coalescer. (No work has been done on these).

5. The product load-out facility should be moved to another location if the plant is going to operate continuously. Exposure levels will not permit removal of the product while operating. An alternate is to provide a shielding wall in the present location. (A small space, 3 by 12 feet is available under the stairway to the cells. The wall could be removed, and this could be utilized for this or another purpose.) If the product load-out facility is moved to another location, more space is available in B-cell and SW wall is then accessible from the hi-lift.

6. There is no place to work on or to decontaminate "hot" equipment, except in B-cell. Equipment must be quite "clean" to take it to the "Hot" Shop. It generally cannot be worked on in place because of the background exposure readings. Even work in B-cell, when it is decontaminated, is generally limited by the cell background rather than by the equipment which is to be worked on. Thus, a "hot" Hot Shop is needed. This is difficult with the present building, but perhaps even the installation of walls inside of the existing Hot Shop would help. These could enclose the middle section of the shop. See the "hot shop" discussion for further details.

7. Are some additional column changes desirable to meet processing loads or requirements? (i.e, bottom interface, flow sheet changes, should ion-exchange or silica gel be provided or should another cycle be added?

8. Should gasket changes be made in B-cell? Should at least the first cycle be a flexitallic-type?

9. The pulsers could be moved to a more convenient and maintainable position. Pulse transmission legs could be run to the patio or to an enclosed structure

by B-cell door (above the present Pu load-out facility). The Patio could be changed to contain a pulser enclosure. An enclosure in B-cell with the pulsers mounted on the south wall could be made with a minimum expenditure. Lead-shielded walls or other protection would be required. Then personnel could enter from the "hot" shop through B-cell doors and work on the pulsers without the necessity of thoroughly decontaminating the cell.

10. Another suggestion for pulser maintenance is to install an enclosure wall around the HA column. The HC column could be moved into this enclosure. The pulsers for the two units could be placed outside of the enclosure as well as any other critical items desired (i.e., rotameters and valves, etc.) With this enclosure on the first cycle, low exposures would be encountered in the remaining parts of the cell. This would permit work on most of the cell with a minimum of flushing. Perhaps the need for moving the Pu load-out facility would be eliminated.

11. Consideration should be given to changing the specifications and the manufacturing technique of the valve splines to avoid the aforementioned corrosion problems.

12. A-Cell floor is now higher than B-cell. Perhaps float-type check valves should be installed on the floor drain to prevent A-cell sump from backing into B-cell.

13. The 2B column should be raised. There is not enough head available for good flow control through the valve and rotameter to Tk-17.

14. The HAW line frequently plugged during the Purex runs. A larger rotameter was installed and much of the trouble was eliminated. A by-pass system could be used or the rotameter removed. (Most of the difficulty was with the rotameter.)

15. The Densitrol unit should be relocated and installed directly in the downcomer of the evaporator chest on Tk-81. If the unit will operate with the flow turbulence in this location, it should give a more desirable control.

16. Should B-cell spray system be revamped? Sprays could be relocated and steam motivation provided for flushing the columns and walls. Much manual flushing would be eliminated.

17. Tk-75 sampler should be revised to eliminate the long piping hold-up. The line could be run through the door to A-sample gallery. A vacuum system with a line blow-back would be better than having the full head of Tk-75 in the sample line at all times.

18. The "air tugger" hoist leaks oil badly. New seals are needed.

201-C - C-CELL

Status of Services -- All water, steam, electricity, and air are shut off to the cell. Heat is maintained as described under the air treatment discussion.

Contents -- The cell contains all of the installed equipment as used during operations. This includes the product receiving and concentration system, the solvent treatment and feed system, and the inter-cycle make-up and feed systems.

Operating Experience -- Most of the C-cell equipment was quite adequate for operations. Very little difficulty, other than pump failures, was encountered. The capacities were, in general, satisfactory for the rates used (305 to 430 lbU/da.). Concentrator capacities were limiting on both Tk-12 and Tk-17 at 430 pounds per day rate. Tk-76 was satisfactory. Known boil-up rates of the concentrators are given in the Appendix.

The primary difficulty in C-cell was Chem-pump failures. These required the decontamination of the cell in order to replace them. Two sources of failure, bearing wear and electrical shorts, were encountered. See the discussion under Special Equipment for further details.

The Tk-55 header kept blowing back into various connected tanks when they were jetted (or when the sump was jetted.) (now revised.)

The organic centrifuge G-16 kept loosing its seal frequently. Water had to be added about once per shift. No corrective measures have been made.

C-cell, as in A-cell, is difficult to maintain; ladders are difficult to position; and the placing of scaffolding is tedious and time consuming.

Changes and Improvements

Operational

1. Heat exchangers for the 1BS and 1BXF streams were installed to permit operations at higher temperatures.

Maintenance Program

1. Tk-18 and all of its associated equipment were relocated to provide space for a lead-shielded pump house.

2. A lead-shielded enclosure was installed just inside C-cell door. The walls consist of a 1-inch lead sheet encased by 1/4-inch stainless steel plates. The roof, however, is a 1/8-inch stainless steel sheet. All of C-cell pumps were installed in the enclosure, except P-21 which still remains on the bottom outlet nozzle of Tk-21. A drain pan was installed around the pump locations to catch pump leaks. The discharge lines of the pumps are sloped upwards from the pump to the recirculation orifice at the tank and the suction lines are installed to drain the pump contents back to the tank. Lead-shielded "mail boxes" were installed for each pump filter in order to reduce the reading inside of the pump house.

3. P-13 was removed to Tk-70 area and a Chem-pump was installed in its place. There is no longer a valve on the pump suction line.

4. An alternate 2BW routing was installed to Tk-15 in order to duplicate the Purex Plant routings. A non-bellows seal-type valve was used.

5. An alternate organic feed system was installed to G-16 from Tk-15, via J-15-2 (4 liters per minute designed capacity) to permit direct centrifugation of Tk-15 contents.

6. An alternate organic route from the IO column to Tk-21 was completed. Thus, organic may be directly washed in Tk-21 when desired.

7. A G-16 by-pass line and valve was installed to permit the routing of the organic from the 10 column to Tk-16. (Used if the centrifuge fails.)

8. Installed the following jet systems:

J-76-4 to Tk-21 (allows the use of 76 for waste concentration).
J-76-5 (allows the jetting of 76 while boiling to 57 via E-76-2.
J-21-3 to Tk-78 (short dip leg allows the transfer of organic and aqueous from the interface).
J-11-2 to Tk-76 (allows transfer of A-cell material to C-cell without using Tk-69).
J-15-2 to G-16 (allows direct centrifugation of organic without passing through the 10 column).

9. J-21-2 was replaced with a 10-gpm jet and the discharge line was changed from 1/2 to 1-inch pipe.

10. The Tk-76 overflow to E-76-2 was altered for the installation of J-76-5.

11. J-17 to 55, J-76 to 55, and J-76-1 discharge lines were raised three feet to prevent any blow back from the header instead of the bottom. This should eliminate start-up troubles with aqueous in the organic stream.

12. The 1BS stream outlet from P-16 header was changed to the top of the header instead of the bottom. This should eliminate start-up troubles with aqueous in the organic stream.

13. P-21 recirculation line was added.

14. AOV 78-2 was relocated to provide recirculation of Tk-78 contents to Tk-21 or Tk-55 header.

15. A syphon breaker vent was provided on the jets: J-13-2, J-21-2, J-57, and J-78-1.

16. Some of the nozzles on Tk-76 and Tk-57 were regasketed and Flexitallic gaskets were installed on the steam and discharge lines of J-14, J-57, J-10, J-9, J-17-3 and J-12-2.

17. The steam traps in the cell were overhauled.

18. All agitators were checked for proper operation.

19. A new route for the Tk-7 to Tk-11 line was provided. This was done to give a larger discharge line for J-7 to Tk-11 transfers.

20. Recalibrated Tk-14, Tk-15, Tk-16, Tk-11, Tk-57, Tk-18; and Tk-9 because the pump suction lines were extended to the pump house.

21. Contaminated spots were removed from the floor and patched with ceilcrete.

Required Items

1. Routine checking of all equipment for operability and leaks.

2. Paint a portion of C-cell floor.

3. Check P-21 and P-13 for proper rotation.

4. Check the calibrations of C-cell tank that have extended bottom outlet to the pump house, if interested in the exact tank volume. All of the calibration books will need changing.

For Consideration

1. Should there be a jet from Tk-21 to Tk-15 or some feed system to the centrifuge from Tk-21?

2. Should another product concentrator be installed or some system adapted to increase the capacity of Tk-17?

3. Should some means be considered for increasing the concentrating capacity of Tk-12?

4. Should the spray system be modified to provide steam motivated chemicals for external decontamination of the cell equipment?

5. Should a pond header shut-off valve be installed outside of the cell? This would permit isolation of C-cell while A-cell is still operating.

6. Continuous removal of the contents of Tk-12 to Tk-13 would be desirable if the plant is run continuously. An air lift would accomplish this.

7. Should the non-bellows-seal valves be replaced by a bellows-seal-type?

8. Flexible electrical connections on the pumps would aid removal and maintenance. Actual receptacles would eliminate a great deal of electricians expense and would assure proper connection every time.

9. "Dog houses" may be necessary to shield individual pumps while others are being worked on.

10. Cell lights, particularly in the pump house, would be beneficial.

201-C HOT SHOP

Status of Services -- All steam and water is shut off. The steam will remain off unless it is required, for the auxiliary heaters, in order to keep the shop above freezing during the winter. Electrical service is on to the main switch box; but all circuits are off except that to the supervisory air pump. The status of the building heat is indicated under the air treatment room discussion.

Contents -- This includes maintenance tools, bins, drills, grinder, fresh air pump, tables, sample equipment (bases, bayonets, trombones, dilution flasks, Gilmont sampler pipettes), fire deluge system, boxes of various contaminated pieces, and the new high lift.

Operating Experience -- The Hot Shop had many limitations. Some of these were:

1. It was too much of a multipurpose room where all of the crafts and operating personnel converged to do their job. Congestion was predominant.

2. Material had to be quite "clean" before it could be released to the Hot Shop. If hot, masks were required in the general area. Consequently, the work of other personnel was curtailed while a single contaminated unit was handled.

3. The floor space was too small. Roped-off zones had to be set up for working on contaminated equipment. This only added to the congestion in the

area. Craft jobs could not easily be separated and each had to take his turn.

4. Contaminated equipment could not be welded in the shop without placing the entire area on "masks".

5. The hood space was far too small. Decontamination of tools alone kept the one hood congested.

6. Facilities for decontaminating equipment was not adequate. Chemical flush facilities were not available.

7. There was no overhead crane facility for the length of the shop. The existing track did not extend outside the building where trucks could be loaded in a "cold" zone. Some could not back into the Hot Shop, because of their size or because the shop was contaminated.

8. There was not enough storage space for materials and supplies. A contaminated material storage vault was needed where contaminated items could be stored until future use.

Changes and Improvements - (Operating)

1. A portion of the area above B-cell stairs was covered. Bins and lockers were installed to contain maintenance supplies and tools.

2. A removable mezzanine platform was fabricatated to permit observation of B-cell from the Hot Shop when the cell doors were opened.

3. A higher capacity fresh-air pump was installed with a safety surge tank, failure alarm, and supply line.

4. Cord winders for extension cords, permanent welding leads, welding outlets to the cells, and inert gas supply outlets were installed.

5. A pump-test stand was installed where pumps could be operated before their installation in the cells.

Changes and Improvements - (Maintenance Program) - None

Status of Equipment -- The deluge system water supply is off, but the fire alarm system is still in operation and will transmit a signal to the control room. All of the tools and supplies remain in the shop ready for use and no changes have been made.

Required Items -- None known.

For Consideration

1. The fresh-air system could be expanded (see Fresh air system discussion).

2. The shop needs more space. One or two things could be done. An enclosure could be built in the middle section of the shop where more highly contaminated material could be worked on without being in a cell radiation field. This enclosure could, also, be used for the welding of contaminated equipment. The entire middle section of the shop could be enclosed, if desired. Thus, walls would isolate a section from A-sample gallery door to C-sample gallery door.

Heating, ventilation, lighting, benches, bins, etc. would have to be rearranged. However, access to the Hot Shop door with equipment and the limited working space is disadvantageous.

Another solution would be to build a separate addition to the Hot Shop, which would contain several hoods and other equipment where contaminated pieces could be worked on as well as decontaminated. This type of addition has been presented on SK-2-50154.

3. More bin or storage space would be helpful in the present shop.

4. The pump testing station could be improved considerably.

5. There is need for a contaminated storage zone where contaminated pieces could be stored and still remain conveniently available for maintenance use. This could be included in conjunction with the Hot Shop enclosure or addition. Thus, many items could be reused instead of discarded.

6. The means of decontaminating small pieces are poor and too much labor is involved. A general facility with enclosed sparge drums could be equipped with wire baskets, agitating devices, and a chemical addition means from the 271-C Building. Drums for washing, rinsing, antirust dipping, and drying could be included. Chemical supply bins and head tanks could also be considered to retain small quantities of decontaminating agents.

7. Additional storage space could be easily obtained by enclosing the space under B-sample gallery stairs.

8. A sand-blast hood has been needed to clean up material (both contaminated and uncontaminated).

Sample Galleries (A-, B-, and C-cells)

Status and Contents -- All services to the galleries are shut off. The galleries contain all of the cell sampling equipment--TBP-type samplers, trombone or bayonet samplers, the Gilmont dilution samplers, and the Gamma monitor, the p-H, and the Polarograph in-line instruments. All of the service outlets remain in A-sample gallery for the alpha monitor which has been removed.

Operating Experience -- The TBP-type sampler worked quite well, however, several things were troublesome and could probably be improved. Several times the sampler capillary tube would plug. However, inserting a wire down the capillary usually relieved the plug. Knowing whether one had a sample was also a problem, since there was no visible way of seeing the bottle. Operating personnel devised some tongs which they used to lift the serum bottle from the sample base. They could then see if the sample was sufficient.

The sample base threads developed binds so the cap could not be turned. A tap-and-die set was purchased and this galling was remedied. The small rubber washers that provide a seal between the bottle top and the sampler "gooseneck" were continually sticking and pulling off. Many of them had to be replaced quite frequently.

Radiation exposure to personnel on some of the samples was quite high. A portable lucite shield was devised and used in front of each sampler to protect the individual from the Beta radiation.

There was little trouble with the trombone sampler, except when the tips would not unscrew in the door stops. As usual, trombone samples were somewhat messy.

Several means were used to take large samples successfully. On those that had in-line instruments, small diversion valves were installed in the line and the sample routed through the catch bottle. On others where there were no lines above "deck" a small cam operated switch box was connected to the sample jet valve electrical leads in the control room. The on-off action of the switch provided the necessary cycling. On some, a receiving bottle was fastened to the bottom of a special TBP sample base with a bottom outlet. Other large samples, including HAF, were obtained by using a cask in the sample gallery and connecting the tubing into the sampler cup and turning on the sampler until the flask was full. All of these techniques accomplished their purpose, but were time consuming. Special designs could be incorporated to greatly facilitate the tapping of large samples of solutions.

The ASCO air supply valves on the jets of the in-lines worked quite well. However, three started sticking and had to be replaced. The ASCO sample process valves also worked well; but their source of trouble was with the seating material. It had to be soft enough to seat properly and yet, withstand the process solutions. Many of the materials used were installed on the plant. These seating materials need further development for continued operation and standardization. The valves generally would leak after prolonged operation.

Gilmont Sampler--The Gilmont sampling procedure was satisfactory, but the reliability of the samples has never been fully proven. The sampling was quite time-consuming and cumbersome. The specific gravity determinations required the greatest portion of the operator's time. General design faults of the unit were

a. The unit was too large. If the size were reduced by one-half, the unit would probably be easily workable.

b. The supporting stem above the track was too long.

c. The sample pipette and the neck of the sample cup were too long. The vertical travel of the pipette was too great.

d. The sample cap and lifting assembly did not operate easily.

e. The tips of the pipette became dirty quite frequently and require cleaning.

f. The oil system frequently contained air pockets or leaks.

g. The oil reservoir required frequent filling.

h. The location of the rinse bottles on the wall behind the sampler was poor.

j. Tips were continually contaminated and this would be transferred to the coveralls of personnel who passed the station.

Enough trouble was experienced with the unit that an entire spare unit was mounted on the wall behind the sample vault. It was ready for use, if the unit in service failed.

In-Line Instruments

Alpha Monitor -- The alpha monitor performed quite well (considering its complicated design). After its "shakedown", about the only maintenance required was to empty the foil chamber that contained the old samples.

Gamma Monitor -- The gamma monitors performed very well, except for the sample cell. It was very difficult to keep the cell background down. Various cell materials and coatings were used and none were entirely satisfactory. The coatings would eventually disengage from the cell wall. Thus, changing of the sample cells was a continuing chore. Some of the cells could be flushed and returned to service for a short time. Also, some of the streams were quite radioactive and it became necessary to shield the supply tubes to the sample cell.

Polarograph -- The results of the Polarograph were questionable. Its primary difficulty was in maintaining a reliable sample cell unit. The dropping mercury electrode was one of the sources of trouble. (Organic material and decontaminating agents were both detrimental to the unit.) Removal and maintenance of the probe was messy and radiation exposure was high. (It is located on the HAW stream to indicate waste losses.) Also, it was necessary to remove the mercury from the sampler frequently. The helium sparge was 'touchy' and special procedures were required to prevent blowbacks in the sparge line. The unit needs further development to provide a reliable, trouble-free installation.

Uranium Photometer and Uranium Absorptiometer -- These instruments worked quite well. They were very good for an indication of the trend of the uranium saturation. Their precision was good, but improvement is desirable if the results are to be used as absolute values.

Spectrometer -- This instrument performed well. Indications of the relative amounts of the important fission products were readily obtained. However, the instrument was not used very frequently.

Ph Meter -- This unit was very useful and proved its worth on waste neutralization. It did, however, require a lot of maintenance to keep the servicing solutions --rinse and buffers--supplied to the unit.

Changes and Improvements -- Only minor changes and improvements were made during the last operating period. The Tk-69, Tk-7, HAW, 2AW, Tk73, Tk-6, Tk-3, Tk-55, and Tk-64 samplers were changed to all-welded piping during the recent Maintenance Program. All connections in the trench are not welded, however.

Status -- All samplers were tested for operability and were found satisfactory. The in-line instruments; however remain just as they were turned off. No maintenance or checking has been done. Some instrument components have been borrowed (see Appendix list).

Required Items -- Maintenance of the in-line instruments and checking of the Gilmont sampler.

For Consideration

1. There is difficulty knowing when the samplers are circulating properly. Circulation could be indicated bv small vacuum gauges connected to the hoke valve at the back of the TBP-type samplers. Erratic cycling of the gauge would indicate good sampling.

2. The rubber gaskets which are slipped on the Teflon tip of the gooseneck (TBP-type samplers) are a problem. These could be made an integral part of the tip. Also the caps for the top of the sample bases are a problem. The press fit does not retain the washer.

3. Work needs to be done on the seating material used in the solenoid valves on the in-line process streams. Standardization on two types of material is needed, if a universal material is not available.

4. Development work is necessary on a sample cell of the gamma monitors to eliminate the high background problems.

A-Pipeway and Valve Room

Status of Services -- All water and air is off to the pipeway. Steam and electricity will be provided during the winter to the space heater which is controlled by a thermostat located in the pipeway. A switch, which regulates the manual or automatic control of the unit, is placed by the pipeway door in the control room.

Contents -- All of A-cell service valves and supply lines.

Operating Experience -- The only operating problems were associated with the operation of the valves on the water, steam, and air service. The primary problem was with leakage through the valve while shut off. This was not too serious, except on the jet valves. The steam leaked through the steam valve and discharged into the vent header which drained to the sump in A-cell. Continual sump build-up from this source was experienced. Small condensers were even installed to catch some of the steam and route it to crib tanks. Also, this steam (and condensate) would leak past the block valves and cause dilution of material in the cell tanks. There are two types of valves in service. One is a Foxboro, motor-driven, Lukenheimer valve. This valve has replaceable fiber discs on the on-off style. Replacement of the seat and disc, generally, solved the leak. These valves gave very good service. The other type is a

George Dahl product which was purchased with an all-stainless steel and nickel alloy plug and seat. This material was badly grooved by the steam and even new units would not give a tight shut-off. It became necessary to order a fiber-type plug and metal seat for these valves. After the installation of the fiber faced plug, their operation was satisfactory. These new plugs and seats are now stocked in Spare Parts.

Changes and Status -- The concentrator valves did not give good control; therefore, pressure-reducing valves were installed on the steam supply to each.

Status -- During the maintenance program, all of the valves in the valve room were removed, tested, and replaced. All strainers were cleaned and everything should be in good working order. The cell-spray headers were revamped for simultaneous steam and water addition.

Required Items

1. Steam lines are capped off at the north end of the valve room. Lines must be reconnected.

2. The water line is turned off at the north end, where it comes through the floor. It must be reconnected.

3. Turn on the air by the stairway at the north end of the pipeway.

For Consideration

1. Some of the block valves have been raised about 12 inches to prevent condensate from running into the cell tanks through leaky valves. This program could be continued if it is deemed worthwhile.

2. In order to use chemicals in the cell-spray system, additional lines must be installed to the existing headers. If high "heads" are used, a special pump should be installed in A-pipeway. See the decontamination discussion.

3. The floor could be revised in the pipeway to provide a slope for flushing and drainage. This would eliminate the existing water ponds whenever a leak develops.

C-Pipeway and Valve Room

Status of Services -- All water and steam lines are blanked off, and the air is shut off. Steam and electricity will be provided to the space heater during the winter. The fan is controlled by a thermostat located in the pipeway. A switch, which regulates the manual or automatic control of the unit, is located by the pipeway door in the control room.

Contents -- All of C-cell service valves and supply lines, as well as B-cell pneumatic transmitters, capacitance transmitters, and instrument lines.

Operating Experience -- Experience here was the same as in A-pipeway and valve-room. The Republic transmitters operated quite satisfactorily; of course, calibration checking was frequently required. Checking of the capacitance transmitters was easily done after the purchase of a capacitance box.

Changes and Improvements -- Operations

1. The HCX and ICX exchangers were installed for high temperature operation.

2. Installed the 1F column instrumentation.

3. A valve test bench was installed for the repair and testing of the valves in the valve rooms. The discharge of the test valves was tied into C-cell vent header. Valve operation on either steam or air was easily tested.

Status -- During the maintenance program all of the valves in the valve room were removed, tested, and replaced. All should be in good working order. Some of the Republics have thick diaphragms and some have thin diaphragms. The thick ones were used initially in an attempt to stabilize the signal; however, many of the units with thick diaphragms continued to shift in calibration and their diaphragms were replaced by thin units.

Required Items

1. Remove the blank in the valve flange on the steam lines.

2. Reconnect water lines in the pipeway.

3. Turn on the air supply by A-pipeway door

For Consideration

1. Same as in A-valve room

2. The spray system in C-cell could be revised for steam motivation of decontaminating solutions. If so, the pipeway would need revisions on the spray headers to permit steam and solution addition.

Air-Treatment Room -- All of the services are functioning during the winter months. (Main steam supply is off during the summer.) The louvers on the cell supply units are now open. The fans are not set to run; but the steam to the preheat coil will be turned on manually. The draft through the unit, created by the stack fan, will supply the heated air to the cells. The reheat coil will not be used unless it is required for additional heating. The cell supply fans should not be run without increasing the stack fan speed since a positive pressure would result in the cells. A vacuum of 0.25 inches of water is presently maintained.

The inlet supply louvers on the Hot Shop unit are totally closed. This permits total recirculation of the Hot Shop air. The unit will automatically control the steam consumption to maintain a 50° F temperature.

Contents -- The air supply and heating units for A-, B-, and C-cells and the Hot Shop.

Operating Experience -- The cell supply units were satisfactory; however, the Hot Shop unit did not have enough capacity to keep the Shop at a comfortable temperature during freezing weather. Thus, two space-heating units were installed in the Hot Shop to provide auxiliary heat when required. The Hot Shop unit is designed to provide recirculation from the Hot Shop;

however, this was generally not used, since it was desired to obtain as much fresh air in the shop as possible to keep contamination levels down.

Changes and Status -- The effluent condensate piping was completely repaired on the cell supply units during the Maintenance Program. The units are ready to operate.

Items Required or For Consideration -- None known.

GENERAL AREAS

A-Courtyard -- This area is currently covered with an oil spray and an overlay of crushed rock. Surface contamination under this varies up to 100 M Rad. No detectable contamination is now present. Neither the cyclone fence nor the blacktop were replaced because of the uncertain nature of future operations. The courtyard area was satisfactory for operations, but the control of contamination was difficult. There was insufficient room within the enclosed area to set both the cell cover blocks and the cover lids. Some of these had to be set outside the area. The fence was in a bad position for the crane and was located about where the crane should be spotted in order to remove the cell cover blocks. Location of the jumper decontamination box, recirculation pump, and tank made the area rather congested.

Binoculars were used when replacing pump jumpers. This closer view was very helpful, although, lighting of the pump jumpers was a problem. There is still need for some powerful spotlights which can be directed on the jumpers from overhead. (Changing jumpers in sunlight is difficult because of the poor lighting.) The mirror (stored in A-sample gallery) which fastens to the wall bracket should be relocated. At present, it cannot be adjusted so that the crane operator and the rigger can see the same view at the same time. One of the cell cover blocks has a bad crack in one side. This resulted from dropping the block into a cell opening.

The gasket on the underground waste line to 241-C Tank Farm developed a leak, and quite generally contaminated the underground area next to the 201-C Building and next to the east area fence. The line was abandoned and rerun to a new helix south of the contaminated area. See the Appendix showing the underground areas that are contaminated as a result of the leaks.

C-courtyard -- Satisfactory -- No comments necessary

Patio -- The exhaust fan and the vacuum pumps for the air samplers are off.

The exhaust fan performed satisfactorily. One motor burned out and was repaired. The filters were changed early in 1956. The vacuum pumps used an excessive quantity of oil and were overhauled during the Maintenance Program.

Waste Disposal Areas -- Cribs -- All cribs were functioning satisfactorily at the time of shut down. The total volumes discharged to cribs and crib status are shown in the Appendix.

During the Redox processing period, the 216-C crib capacity was exceeded, and it became necessary to route the cooling water from the tank coils, jackets, and condensers to the C-Plant excavation. Later the leaching pit was blanked and the service building drainage was sent across the road to the excavation.

No continuous monitors are installed on the water discharged to the C-Plant excavation. In case of coil leak or rupture, fair amounts of radioactivity could be discharged before detection.

Poor steam trap operation in the cells caused the marble chip tank (Tk-71 used for acid neutralization) to issue steam. A contact condenser was installed on the riser and a small water supply was run from the air-treatment room across the road to the unit.

Waste Tanks -- No particular trouble was experienced with the waste tanks -- Tk-70 or the C-farm tanks.

Stack Filters -- All filters operated quite satisfactorily. No build-up in pressure drop was experienced. However, the ventilation filter bed picked up considerable activity and it became necessary to establish a radiation zone. It currently has readings of 20,000 c/m compared to over 30 M rad during operations. This decay indicates the filters will be satisfactory for future use. However, the possibility of changing the filters should be investigated. The off-gas filters did experience some pressure build-up from moisture condensation on the initial start-up of the units; but no trouble has been encountered as long as the effluent gas has been heated above the dew point. F-5-3 (East) connector in A-cell was used through the Redox runs and F-5-2 (middle) was used during the Purex runs. (This one is still in service.) A valve activator is connected to the west filter inlet (F-5-1) and is reserved as a process spare.

Underground Lines

1. Pond Line -- This tile line does not have enough capacity for full scale operations. Flow creates a back pressure of 0 to 5 psig. Also the line is not self draining. Since the line is all tile, it may be broken although there is no visible evidence of this. The pond relief line was placed in service during operations to relieve some of the back pressure. This is a 3-inch galvanized line that runs past the Deminerilizer Building to the C-excavation. The line is presently capped just outside of the southeast corner of A-cell. If full scale operations start, the line will have to be rerun to the south side of the Demineralizer Building, where it can be connected to the old line.

2. 241-C Line (2-inch stainless steel) -- Originally this line was flanged in three places; beside 201C, near the Semiworks fence line, and by the 152-Diversion box. The Teflon gaskets in these flanges leaked and it became necessary to by-pass each. The line at 201-C was abandoned (radiation readings of greater than 100 R were obtained) and the line was rerun (from about 20 feet east of the building to a new helix). The flanged section by the fence was also abandoned and piping was installed around the "hot" dirt flanged section of the line. This same method was used to by-pass the flange by the 152-Diversion box. The waste line to C-farm is now all-welded. A back-up ring was welded over each of the welds and the line was not pressure tested.

3. All process and sanitary water lines are shut off as indicated on Sk-2-2308.

4. Tk-72-line -- When the jet on Tk-69 to 241-C failed (because of gasket failure), it became necessary to have another system for transferring waste to the tank farm. Thus, a valve was installed in the Tk-72 line and a crossover line was connected from the Tk-72 line into the 241-C pipe.

A rise was placed in the line to prevent solution crossover while jetting into one of the lines. This should be checked when the first transfers are made to 241-C via J-69-1 to assure that the solution will not go to Tk-72 if the valve is open or recirculate to Tk-69 if the valve on the 72-lines is closed.

5. New underground lines were installed to Tk-72 when the underground signal cable was ruined by other excavations. A 1-1/2-inch conduit with ten leads was installed from the pipe trench beside 217-C. Also 3/4-inch line for instrument air supply and a spare 1-inch line were installed. These all originate at the pipe trench and terminate in the 241-CX building.

6. A water line was run to the contact condenser on Tk-71. The water supply comes from the air-treatment room and runs under the road to a self-draining shut-off valve and into the condenser.

7. The line to the old leaching pit is blanked off at the pit (now filled) and a line runs across the road to the C-excavation. This handles all of the building drains.

8. All lines are shown on Sk-2-4010.

MISCELLANEOUS

Hi-Lifts -- Two high lifts are currently located at the Hot semiworks. The Economy Engineering Company's lift in B-cell has been in service since the start-up of the plant. The unit has operated satisfactorily; however several modifications were made to improve the lift. A transformer was installed to provide 110-V outlets on the platform in order to handle portable electrical maintenance tools. An outrigging platform was installed which would telescope out 18 inches in a horizontal direction. This provided a platform closer to the desired working area. A limit switch was installed to prevent operation of the lift while the platform was extended. The electrical supply cable was a problem. It has previously shorted and started the operation of the lift. Also the bottom limit switch has failed and the cables wrapped up backwards on the drum. The lift was generally twisted and wrecked. It was then dismantled and removed from the cell. Repair followed and it was reinstalled in the cell. A Tel-e-talk station was later installed on the hi-lift platform to permit communication from the Hot Shop to the lift. Before the lift is operated again, all mechanisms should be checked over thoroughly. The cables and the electrical wiring and switching need particular attention. Some may need replacing.

Generally, the lift is hard to maneuver in the cell and the exposure time of at least two men is required to "spot" it. Consideration could be given to an electrical motivating system for at least the new unit that is installed. The breaks and screws were hard on the painted floor and should have a cushioning material installed on the pads.

The new Atlas high lift is currently located in the Hot Shop. It was purchased in 1956 and has not been used.

Several modifications were made after the lift was received. They were as follows:

1. The wheel mounting was altered to permit turning of the front wheels by a worm gear drive. This allows stabilized mobility of the lift in any direction.

2. Installed explosion proof electrical currents and a 1-KW transformer for 110-V connection on the lift platform.

3. Installed a load limit safety switch.

Before the lift is placed in service in the cell, the following should receive attention:

1. The rubber wheels should be replaced with all steel wheels which would be easier rolling on the concrete floor. (Also, the tire rims were damaged when the lift was placed in the Hot Shop.)

2. The screw jacks need some more frame welding and better pads.

3. Should outriggers be installed? How much does it take to tip the lift over? (This could be tested with a crane.)

4. Bins or shelves could be installed on the platform to retain tools, etc.

5. A splash shield could be installed around the motor and chain drive.

6. The unit should be painted.

Vacuum Cleaner -- The industrial vacuum cleaner was found very useful in keeping the working areas clean and was used quite extensively. It is currently located in the Hot Shop and is in an operable condition. However, a new hose is needed. The cleaner was also used to provide vacuums in drums for cleaning areas, like A-cell sump. A portable Electrolux unit was also used in contaminated zones to pick up dust, etc., wherever flushing was not advisable.

Fresh-Air System -- The fresh air system currently has a limited capacity of five fresh-air masks. Although this is usually all of the hose that can be handled in one cell, more are desirable when work is progressing in several cells. The system consists of one MSAL-673 pump, a water separating pot, and a surge tank. An alarm is also installed to notify a pump failure. The system could be expanded by installing an additional unit beside the present pump. The spare pump (located in 217-C) was removed from service because the capacity was too low. It will only supply one to two men. The capacity of this unit could probably be increased to four men by replacing the pump parts.

Small rubber hose were initially used on the mask distribution system but they would not allow enough air supply to the mask when more than 50 feet of hose was used. Also, they became quite badly contaminated. Thus, plastic garden hose were purchased and found quite successful. (The more pliable plastic hose is preferable.) This did not become as badly contaminated and gave a greater air supply to the mask. Handling of the supply hose while in SWP clothing is cumbersome. It has been suggested that automatic hose reels be purchased to alleviate the hose storage and distribution problem.

Welding and Maintenance

A Miller, Model SRTA-3 ABP, welding machine was purchased for the maintenance program and was very satisfactory. It had remote heat adjustment features (at the top of the torch) and an automatic gas cut-off system. Thus, the welder could obtain the conditions he desired without having another man standing by the machine to adjust it. Utilization of this type of machine is highly recommended for any future welding in the cells.

There is need for some type of portable pipe beveling machine which would bevel pipes while they are in place. This should be something that does not use grinding since fresh-air masks have been required for the grinding of "hot" lines. The machine could be attached to the pipe in place and, thus, quickly bevel the pipe properly for welding.

Chempumps -- Although these pumps performed the job, their operating life was not reliable. Two types of failures were predominant. The stator windings would short or the bearings would wear until the rotor rubbed the stator. The winding insulation on many of the pumps must have been of poor quality and would not withstand the heat rise of the pump. Also the lead wires were only cloth coated and were quite moisture sensitive. Moisture in the conduit would cause these to short.

The bearing material, pile graphite, would not withstand the service. Severe scoring of the shaft occurred and the general life expectancy of the pumps averaged about 1200 hours of operation. The process solutions were apparently a determining factor since the organic handling pumps were always in good shape compared to the aqueous pumps. Strainers were added to each of the bearing recirculation lines of the pumps. It is not known how effective these may have been; however, each strainer held considerable radioactivity when it was removed, Subsequent units have been installed with lead-shielded retaining cans ("mail boxes").

Proper rotation of the pumps is hard to determine since they pump with either forward or reverse rotation. The amperage was not a positive indication of proper rotation. Flow indications with a constant valve setting were used with fair success. However, all of the connections should be standardized so that the pump would run in the right direction when installed. Only simple coding and phase checking should be required. The pumps should all be installed with a length of flexible conduit run to the housing. This permits removal of the pump from its flanges without disconnecting the electrical. Many times only a small job is required to fix a pump. Even spare rotors and bearings could be installed quickly without disconnecting the electrical. Also quick disconnect electrical plugs could be used for the pump connections. This would greatly save electricians exposure and also assure that the pumps would be connected for proper rotation every time.

Slug Charger -- One charging cask is available for the Hot Semiworks. It was utilized throughout the operating periods of the plant without any difficulty. The cask was loaded in the 100-Areas and transported by truck to the Semiworks site where a crane was employed to move the cask to the charging platform. Slugs were discharged by turning the manual crank through a complete cycle of rotations in one direction. The unit worked very well. No change in the system is needed unless other slug designs are employed. The water tank which is used to contain the charger while in transit was found unnecessary for shielding and was not filled with water during the Purex chargings.

Fire Protection -- All of the fire protection and alarm system remains intact; however, the water is currently shut off to the 276-Building deluge system and the A-, B-, and C-cell deluge system. The alarms are all in operating order. The deluge system to the cells was never left on automatic because an inadvertant discharge would fill the cell full of water before the system could be turned off. Heat rise in the 276-Building has turned the 276-system on several times. The fire systems seem to be adequate; however, there is no fire sensing device in the Hot Shop. Coverage at this location is desirable.

Safety -- The Safety record at the plant was excellent. No major injuries occurred even though the work was quite hazardous.

Major hazards were:

1. Accessibility to equipment was poor. Personnel had to climb on ladders, pipes, and tanks to reach equipment.

2. There was no head protection in SWP clothing.

3. Cell floors were slippery.

4. Danger from falling objects (during maintenance).

5. Overfatigue (in SWP clothing).

6. The Hot Shop is far removed from the change house. Personnel coming from a warm cell are exposed to the weather while returning to the change house.

7. Handling of hazardous chemicals.

8. Handling of chemicals and hose during decontamination.

High radiation alarms should be installed in the sample gallery and Hot Shop locations to protect personnel in the event of an abrupt "blow back". Additional monitoring could also be installed on effluent line such as pond water.

Organization -- The plant was operated with four shift coverage. Each shift consisted of a supervisor (Hot Semiworks engineer), an engineer, two engineering assistants and a technical graduate(rotational training). Service crews on each shift were one pipe fitter, one instrument man, and two radiation monitors. Generally, the Hot Semiworks engineer handled all of the details and organization of the shift and the engineer assumed responsibility for the proper operation of the equipment and the collection and initial correlation of the data. The shift assignments were, generally, broken down into the following: an aqueous makeup, head end, and concentrator operator, a first cycle operator, an operator for the remaining equipment, and the sampler and Hot Shop operator. The engineer assisted all phases of the operation, operated the in-line instruments, and recorded and correlated data.

A straight day crew consisted of one or two engineers correlating data and setting up run specifications; a maintenance engineer, who coordinated all of the plant services and equipment changes; and the plant supervisor. This organization worked out quite well. However, the rotational trainees were not very helpful in operating the plant since by the time they were trained to be of help, they were usually transferred. For continued operation, they could be replaced by an engineering assistant.

Decontamination Experience -- Since the plant is totally contact maintained, much experience was obtained in decontaminating equipment. It was certainly proven that any piece of stainless-steel equipment can be decontaminated with acidic and basic solutions. (All types of structural materials were decontaminated at the Hot Semiworks; but material other than stainless had a tendency to retain activity after repeated flushings.) This demonstrated ability to decontaminate equipment should provide an incentive for reworking of production equipment rather than "conducting burial services".

Three approaches were necessary to decontaminate equipment. First, a thorough flushing of equipment and lines was necessary; second, external flushing of the equipment was required; and third, the "hot" sources had to be located and decontaminated individually. A number of solutions were used for decontaminating.

Some decontaminating reagents were determined by sending actual samples of the material to be decontaminated to the laboratory and subjecting it to a series of solutions to find which one was the most effective. Many times the choice of the agent used was quite arbitrary since it was not known what particular species of fission product or combination of products were present. Generally, however, the principal contenders were zirconium and niobium accompanied by some ruthenium. CT (caustic-tartrate, "hot") was used quite extensively for flushing. This was generally followed with "hot" oxalic acid. Oxalic acid was generally "killed" with hydrogen peroxide to reduce waste volume and to allow more efficient concentration (concentration of oxalic solutions is difficult) (1/7 volume of 30 percent H_2O_2 is required to kill one volume of 10 percent oxalic acid. Seventy per cent is added cold and the remainder after the solution is heated to boiling.).

Another combination which seemed to be effective against ruthenium was PC (permanganate-caustic). This was generally followed with N-FAS (nitric-ferrous ammonium sulfate) to remove the precipitated manganese dioxide. A 3-20 (fluoride nitric) flush was generally used at least once during the decontamination campaign for final clean up. Its repeated use is not recommended because of its corrosive nature. For concrete and painted surfaces the above flushes were generally followed with an ND (nitric dichromate) flush to remove cesium and cerium.

Contact times of most of the solutions generally varied from 1/2 to two hours with agitation or recirculation wherever possible.

A flow system was set up to decontaminate the tanks and the solution was transferred progressively from one tank to another. The transfers were made from low to a high contamination tank. All tanks were generally filled to near overflowing to provide solution contact with the tank top. During the course of these tank transfers all of the auxiliary lines to each tank were flushed as well.

After several vessel flushings, the cell cover blocks were usually removed and the external spraying started from the top side. Nozzles and solution were directed toward the surfaces in the cell. As soon as the readings were low enough to get inside of the cell door, spraying was done with hose from there. This directional flushing was continued on all of the sources found in the cell by the monitors.

A few flushes were enough for most of the equipment and from then on it was a matter of finding the "hot" spots and eliminating them one-by-one. Monitoring and locating of the sources are principal deterrants to decontamination, particularly when a mass of equipment is located in the same area. The quicker the high sources can be pinpointed and removed, the quicker personnel can enter the cell. Many times unneeded cell flushing is done because an area is "hot" from another source. Several devices were used in an attempt to locate these high sources (>10 R). One known as the "Eye" was employed. It consisted of a lead-shielded collimating chamber, a sensing tube, and an indicating meter. This was connected to one of the plant Beckman radiation recorders. A flashlight was attached to the unit. Its beam would indicate the direction of the source when the radiation readings increased greatly. The "Eye" was helpful for extremely high sources, but it indicated direction alone. (It had to be operated from the cell cover block openings.)

A 25-foot extension hurdle on a TP-probe helped considerably in locating sources. Manipulation of the pole was difficult but results were effective. Changing locations of the probe would indicate the direction of the source and eventually locate it. Thus, there certainly is need for some installed system, which would aid in locating sources. Such things as telescoping probes, trolley suspended probes, and additional stationary indicating units would help. Installation of the standard Beckman chambers are expensive; however, smaller units, even say the TP-probes, could be located throughout the cell and readings of these various units would locate the general areas of the sources.

Occasionally unflushable plugged lines were encountered. The electric arc was then used. Lines were cut with the welder standing as much as 25 feet away from the line.

After the cell readings are low enough for personnel to enter, manual labor and exposure time is still required to reduce the limits to a reasonable working period. Generally local flushing of the spots followed by copious quantities of water from a fire hose will suffice. This was supplemented by the placement of lead shielding in stragetic locations.

Most of the decontamination trouble was encountered with painted surfaces, bare concrete where the paint had come off, and exposed mild steel surfaces. Such items as conduit boxes, valves, agitators, motors, and frames were troublesome. Even when the cell background was low, these surfaces contained a lot of Beta activity which had to be shielded wherever possible. A lot of exposure time was attributed to this Beta activity.

Recommendations

1. Decontamination is still pretty much of an art. More investigations should be made to develop better decontaminating agents. It is particularly desirable to have an agent which would chemically react or adsorb the fission products from surfaces. The use of acids should be avoided if at all possible, since the more acid used the more costly the decontamination because of the neutralization involved and its associated waste volume.

2. The use of an electric current for decontamination should be investigated. This has not been tried at Hanford to any great extent. Perhaps inserting an annode rod into a tank and connecting the equipment to a direct current source, such as a welding machine, would eliminate the need for so many chemical solutions.

3. Future use of steam motivation for many of the acid solutions should help. (The pump head available was not sufficient for a good decontaminating spray.) The Kerrick Kleaner was mild steel and would not handle acid solutions. The small stainless Kleaner did not have enough capacity to cover a large area in a short time to reduce personnel exposure. The revision of A-cell spray header was a move in the right direction. If all of the areas of the cell could be covered sufficiently by this method, very little manual work would be involved in decontamination of external parts within the cell.

4. More stainless equipment would be justified, since it decontaminates easily, does not require any painting or repainting, and does not require replacement because of deterioration from acid leaks.

IDEALIZED DESIGN GUIDES FOR A CONTACT MAINTAINED PROCESSING PLANT -- These guides are based on the experiences obtained at the Hot Semiworks. They do not necessarily present the most economical means of construction but do present what is believed to be the most trouble-free and convenient operating arrangement. They are not all-inclusive, but emphasize some of the most important aspects which should be considered. Only items pertaining to the radioactive portion of the plant are discussed extensively:

A. General Plan

1. All facilities and services should be grouped into a single structure. (More convenient, no inclement weather problems, no long distribution lines for services.)

2. Separate ventilation and heating should be supplied (necessary to keep the proper air status).

3. The control room should be above all "hot" equipment. (Eliminates potential syphoning of material into the control room through instrument lines.)

4. Adequate provision should be made for future maintenance of the plant. Equipment access should be good (Reduces maintenance costs and problems).

5. Sufficient storage space should be provided throughout the plant. (Congested work areas are neither necessary nor desirable.)

6. Adequate provision should be made for future expansion. (Foresight of any competitive business.)

B. Aqueous Make-Up Facilities

1. Adequate provision should be made for the addition of dry chemicals. Chutes, hoppers, scales, and etc., should be installed on the floor above the make-up tanks.

2. Make-up tanks should be provided with adequate agitation and heating.

3. Piping should be connected to permit inter-tank transfers.

4. A separate system should be included for the make-up and quick supply of decontamination solutions to all parts of the plant. High head pumps are desirable.

5. All tanks should be connected to a vacuum vent system.

6. Provisions should be made for complete water flushing of the system. Water lines should run to pumps to provide line "clean-out" after pumping. Floors, walls, and ceilings should be flushable. Adequate floor slope and floor drainage are necessary.

7. Adequate chemical storage space, dock and handling facilities should be provided.

C. Organic Facilities

1. Storage separate from the "hot" cell is necessary for new and used solvent. Batch blending for new solvent can be provided in either an organic facility or the cells.

2. Adequate transfer means are necessary between the cell and the organic facility.

D. Hot Process Areas -- Internal

1. Segregation of equipment into compartments with individual (or possibly group), shielding is required. (Convenient selective decontamination and repair is then possible.)

2. Complete overhead access to equipment with an overhead servicing crane should be provided. (To maintain equipment, one must be able to remove or work on it quickly and easily.)

3. All "hot" cell shielding surfaces should be lined with stainless steel (easier to decontaminate).

4. Process pipes should be run in "hot" pipe trenches which have an overhead access. (Isolation of pipes from equipment reduces decontamination effort.)

5. Adequate drainage should be provided in all surfaces. Horizontal slopes should be at least 1/2-inch per foot. (Decontamination is not easy if surfaces do not drain.)

6. All service pipes should converge into a service gallery which should contain such items as instrument lines, condensers, water and steam headers, steam traps and check valves. (Allows maintenance without decontaminating major equipment.)

7. The entire top shielding surface of the cell should be removable. Pipe trench covers should be separate from the cell shielding.(Allows selective access to equipment.

8. Tanks should have the following features:

a. Internal surfaces should be smooth with no traps or pockets. (Easier to decontaminate.)

b. No top entry flanged nozzles should be provided. All tank entries should be by side legs or direct entry piping. (Nozzle necks hold up contamination. Side legs prevent boiling of their contents and subsequent condensation in adjacent vessels.)

c. All connections and joints should be welded. (The number of leaks with welding are few; thus, no external contamination results.)

d. An internal flushing jet and spray should be provided on the larger tanks. (Allows decontamination with smaller volumes of solutions.)

e. Towers on the tanks should be all welded except at the top where a flange may be used, if desired. If so, the tower packing could be suspended from the top and thereby be removable. (Lower flange gaskets in towers may eventually leak.)

f. Decontamination sprays should be provided in the towers; or the in-let pipes to the tank should have sufficient height that the tower may be flooded. (Effective decontamination.)

g. Heat transfer coils or tubes should be such that they could be changed easily. (A side tube bundle can be changed with the least effort when all-welded construction is used.)

h. Spargers should be used wherever applicable. Agitators should not be used on concentrators. Agitators which are used on other tanks should have a complete external cladding of stainless steel. The base support should be completely open for flushing. No mild steel parts should be exposed. (Easier to decontaminate.)

9. The piping should be:

a. All welded with no flanges whatsoever. (No leaks, no contamination.)

b. Run in a systematic x - y - z coordinate fashion and grouped together. (Easier to maintain.)

c. Sloped for proper drainage. (With no traps or pockets, it can be flushed.)

d. Arranged to prevent air pockets and traps as well as undesirable syphoning. Venting is a necessity.

e. Installed with over-adequate seal loops when joining other headers. (Surge "spitting" in other tanks is prevented.)

f. Designed for a decontamination flow sheet as well as the process flow diagram. (Allows economical utilization of solutions.)

g. Spared for additional expansion or changes. (Easier before than after.)

10. Each cell should have a fire protection and decontamination spray system. The fire and spray system should be combined to serve a dual purpose, since steam motivation can be effectively used for distributing the decontaminating solutions through large headers. Full coverage of the cell contents is necessary, however. Deck connections should also be provided for manual flushing. (Allows more economical decontamination without excessive personnel exposure.)

11. Fresh air, electrical and welding outlets should be provided in convenient locations. (Safety.)

12. Downdraft ventilation should be provided through each cell. (Prevents spread of air-borne contamination when the cell is uncovered.)

13. The sump or sumps should be removed from any main operating area. Each should have provision for cleaning the non-dissolvable material. (Any sump is a high source of radiation.

14. Adequate communication and lighting systems should be installed. Cell sound monitoring should be included.

15. Radiation detection devices should be installed to give adequate information on radiation levels and their sources as well as the air status in the area. (When the source is known, it can be decontaminated.)

16. Solutions should be transferred by steam jet, air jet, air lift, or vacuum wherever possible. (No maintenance is required with no moving parts.

17. Electrical service conduit and boxes should be all stainless steel. (Easier to decontaminate.) Quick disconnect plugs and couplings should be used wherever maintenance may be required. Waterproof coupling-plugs should be utilized. (Handling a plug is quicker than cutting and soldering wires.)

18. A scaffolding scheme should be designed into each cell. (Scaffolding cages could be set in place with the overhead crane.)

19. Column pulse generators should be segregated from the column and be maintained from separate enclosures. (A minimum of decontamination is required for maintenance.)

20. Valves should be avoided wherever possible. When used, all parts of the valve should be stainless steel. (Easier to decontaminate.)

21. Control enclosures should be provided to contain instrumentation, such as valves and rotameters. Separate entry is needed through port doors. (Selective maintenance without general decontamination.)

22. Samplers should be small and compact. All welded construction should be utilized. Lines to these units could run into a separate pipe trench.

23. A separate shielded feed storage area should be provided. (To permit prolonged storage while maintenance or changes are being made to the plant.)

24. An equipment decontamination cell should be provided where equipment can be placed, decontaminated and repaired. Crane facilities should be available for transferring units from the cells to decontamination and then to the "hot" shops. (Exposure is too great to decontaminate all equipment in place.)

25. A waste disposal system should be provided with spare transfer schemes. (One doesn't even decontaminate without disposing of waste. Alternate units are an absolute necessity.)

26. Pipe entries into the cells should be made through trenches or chutes, rather than helices. (Easier to change and maintain.)

27. Operating units and controls should be closely coupled. Long transmission should be avoided. (Economical.)

28. Wherever pumps are used, failures will occur. They must be easily replaceable. Hence, they must be capable of remote changing or quick decontamination and changing. The first column feed pump should be changed by remote means. Others should be separated and located in shielded enclosures where only the pump must be decontaminated, if necessary, for removal. If bottom tank outlets are used, all connections should be welded--even the pump parts.

Hot Process Areas -- External to Cells

1. Galleries should be provided for sampling equipment, pipes, valves, electrical leads and instruments.

2. Two "hot" shops should be provided--one for radioactive equipment work and the other for "controlled release" work. Each should have individual ventilation. The shops should contain the following:

a. Adequate working space.

b. Hoods with separate ventilation for welding or special work.

c. Decontamination facilities for tools and small equipment. This should include the chemical supply and handling facilities and automatic washing units for small parts.

d. A waste disposal system for both liquid and dry waste.

3. A product load-out facility should be provided.

4. Facilities for importing or exporting "hot" solutions should be made.

5. Charging mechanisms are required for customer material.

F. Layout

Appendix "Q" shows how one such "ideal" contact maintained processing plant might look. Most of the design guide items are incorporated into the layout. Certainly many mechanical features remain for further development and are too detailed to be included here. Generally the important features are as follows:

1. Large door openings to the outside, with overhead crane service.

2. Individual compartments for extremely hot processing equipment.

3. A pipe trench for hot lines.

4. A pipe tunnel for service lines and equipment.

5. A ventilation and sump tunnel.

6. Down-draft ventilation where floor drains serve for ventilation as well as drainage.

7. Separate pump shielding and mounting. A "canned" (stator and rotor) pump was assumed which is entirely submersible in process solution. This pump may be removed by unplugging the electrical leads and cutting the discharge line.

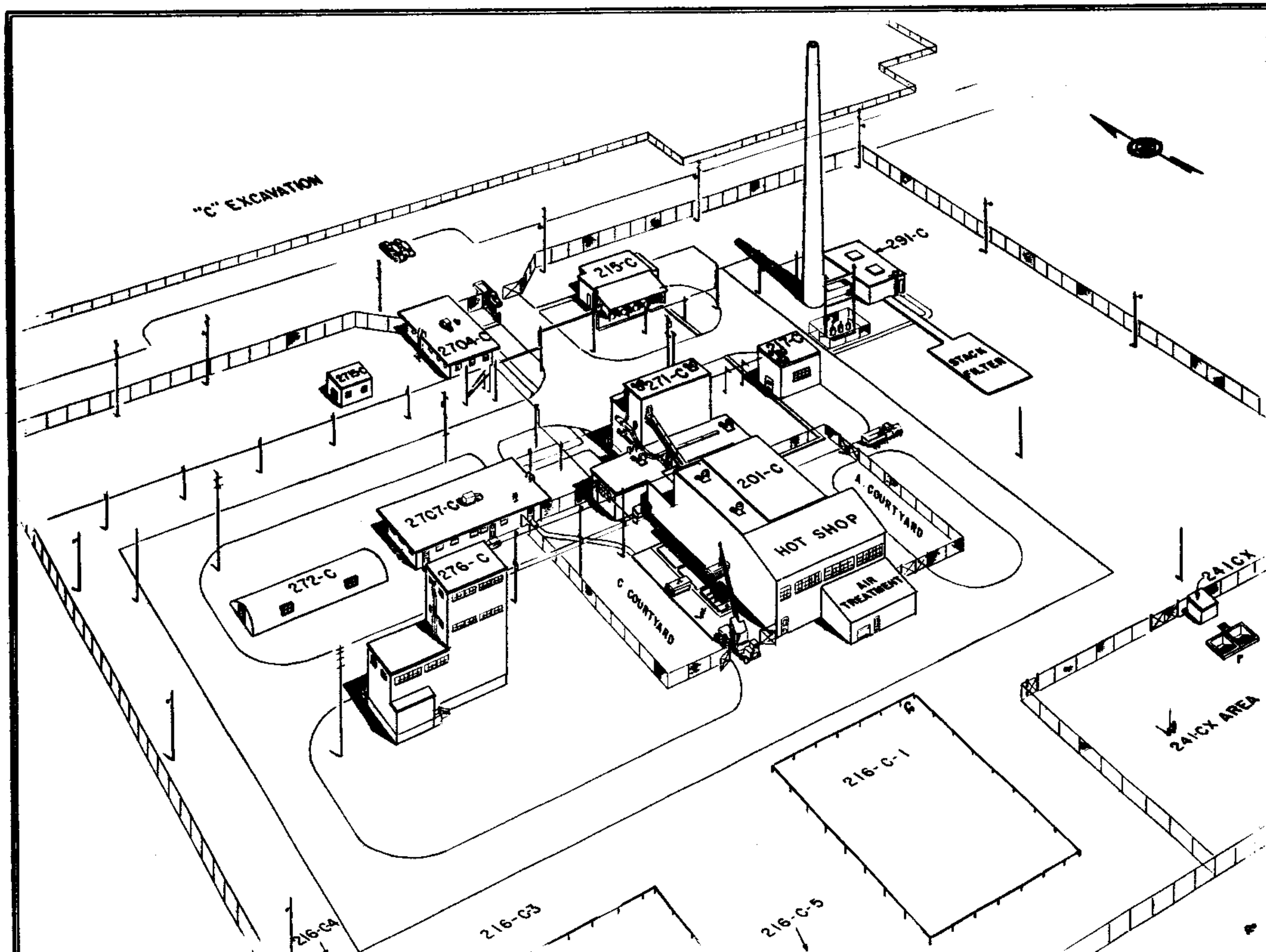
A shielding weight on the top flange mount provides the flange seating pressure. Other types of pumps could be used in a similar manner.

8. Overhead crane access to all equipment and maintenance areas. (Crane passage from one area to another is allowed by retractable or swing doors.)

CRC:pc

C. R. Cooley
Chemical Engineering Development

APPENDIX A



HOT SEMIWORKS PROJECT ENGINEERING DESIGN DIVISION PERSPECTIVE VIEW R. CLAAR '51

NONE 0110

SK-2-661 200C

APPROVED

APPENDIX B

CAPACITIES OF HOT SEMIWORKS EQUIPMENT
--Tested Items--

CONCENTRATORS -- Average maximum values for water

Date Tested	Tank	L. Level	Boil-Up Rate gal./hr.	Tank Pressure, in. of H_2O	Condenser Temperature	Jacket Operating	Comments
12-14-54	12	66"	30.00	0.5-2"	40° C	Yes	*
	12	62"	44.00	1.0-3"	70° C	Yes	HP steam header at 120 psig
11-28-54	12	70"	35.00	1	56° C	Yes	
12-4-54	76	20"	100.00	--	--	None	8
11-28-54	17	55"	5.70	0	44° C	Yes	Jacket only (15 psig) 1 hr required to heat to boiling
5-27-53	17	55"	6.25		65° C	Yes	
6-20-57	55	50"	214.00	5"	75° C	Yes	Tested with leaking coil.
3-31-55	64	24"	42.20	8-16"	60° C	None	*
6-20-57	64	26"	34.00	9-21"	78° C	None	*
6-20-57	73	22"	74.60	26"	38° C	None	*

MISCELLANEOUS -- Water

Date Tested	Item	Comments
6-20-57	64-69 Air Lift	4 cfh of air (roto set at 2) gave 220 ml/min to 870 ml/min (64 full) with Tk 64 boiling (24" W.F. in Tk-64) 2 cfh of air (roto set at 1) gave 200 to 700 ml/min with Tk-64 boiling and from 25" W.F. to full.
6-20-57	73-64 Air Lift	4 cfh (roto=2) gave 620 to 800 ml/min with Tk-73 boiling and a W.F. of 20 to 27" 2 cfh (roto=1) gave 600 to 790 ml/min with the above condition

* 90 psig steam to the control valve. Actual coil pressure was not taken. Steam to jackets was 15 psig

APPENDIX C

HOT SEMIWORKS WASTE

Disposal Receipts

CRIBS

Crib	Size ft.	lb.U	g.Pu	β Curies	Total Volume Received (gal.)	Capacity
216 C-1 (Condensate Crib)	8 x 22.5	643.73	7.16	11,460.00	1,165,815 Est.	*
216 C-2	Dry well	------No	Records--------			*
216 C-3 (Leaching Pit)		-----No	Records--------			*
216 C-4 Organic Crib	10 x 20	7.86	1.6	117.83	12,987	*32,000 gal on specific retention basis
216 C-5 Hi Salt	----	115.1	---	27.28	10,275	
216 C-6 H	----	0.02	0.04	4.40	1,981	*

(Waste self-concentrater Condensate)

STORAGE TANKS

Storage Tank	Total Volume Received (Liters)	Pounds U	Grams Pu	Comments
Tk-70	94,951.00	942.98	226.64	Stainless steel Tk (non-neutralized Redox wastes)
Tk-72	8,723.90	61.22	48.49	Purex waste self-concentrator
241 C Farm				
Tk-201 C	187,559.00	473.68	782.72	
Tk-202 C	175,486.00	877.84	340.42	
Tk-203 C	100,628.00	2,508.96	284.28	Currently connected to HSW line
Tk-204 C				Unused

* Should be determined by Chemical Effluents technology before operation again.

APPENDIX D

HOT SEMIWORKS RADIATION LEVELS

on September 1, 1957

Location	Contamination: Maximum "Fixed"	Contamination: Maximum "Smearable"	Contamination: General	Exposure: Maximum	Exposure: General	Comments
2704-C	None	None	None	None	None	None
2707-C	600 c/m	None	None	None	None	Fixed to mask board in SMP lobby
2715-C	—	—	None	—	—	—
215-C	—	—	None	—	—	—
217-C	—	—	None	—	—	—
291-C	1,000 c/m	1,000 c/m				Smearable around the exhaust duct "Fixed" through duct
276-C	40,000 c/m	None	0 – 3,000 c/m	—	None	"Smearable" on floor has been painted
251-CX Building						
East Vault	100 m rad*	100 m rad*	20 m rad*	100 m rad*	20 m rad*	
West Vault	200 m rad w/20 mr	10 m rads	None, except spots	10 m rads		
271-C						
Control Room	7,000 c/m	None	None	None	None	In instrument tubing
Aqueous Makeup	400 c/m	None	None	None	None	"Fixed" is painted over
A-Cell	17 rad	17 rad w/1 r	20 to 300 m rads	500 m rad w/200 mr	10-25 m rad w/5-20 mr	Wall cracks provide the high Beta sources
A-Courtyard	20,000 c/m	500 c/m	100 c/m	None	None	
B-Cell	12.5 rad w/2.5 r at 6 in.	12.5 rad w/215 r 4x10^6 d/m	5 m rad 2,000 d/m	1 rad	South 2/3 10 mr North 20 mr	
C-Cell	400 m rads 800,000 d/m	400 m rad 30,000 d/m	20 m rad 10,000 to 30,000 d/m	100 m rad	20 m rad	High α has been coated with krylon
C-Courtyard	20 m rad	20 m rad	None	—	< 1 mr	
Patio	15,000 c/m	2,000 c/m	None	None	None	In Filters
A-Pipeway	30,000 c/m	500 c/m	300 c/m	—	< 1 mr	
A-Valve room	55 m rad	1,000 c/m	500 c/m	—	< 1 mr	
A-Sample Gallery	290 m rad w/10 mr	6,000 c/m	200 c/m	50 m rad	2 mr	Spotted Alpha
General ——→	30,000 d/m	3,000 d/m			10 mr	With Trench open
Trench	1.8 rad w/100 mr	300 m rad w/60 mr	200 m rad	360 m rad	100 m rad	No alpha checks made
C-Pipeway	55 m rad	1,000 c/m	300 c/m	—	< 1 mr	
C-Valve room	50 m rad 40,000 d/m	500 c/m	200 c/m	—	< 1 mr	α has been fixed with paint or krylon
C-Sample Gallery						
General	25 m rad	1,000 c/m				
Trench	40,000 d/m	10,000 d/m	Not determined	—	—	No readings taken
B-Sample Gallery	57 m rad 40,000 d/m	1,000 c/m 5,000 d/m	300 c/m 500 d/m			"Fixed" has been covered with Krylon, paint or plastic
Hot Shop	50,000 c/m	600 c/m	200 c/m		< 1 mr	Sink has higher readings
Air Treatment	3,000 c/m	200 c/m	100 c/m		< 1 mr	Fixed filters and on floor

* Estimated

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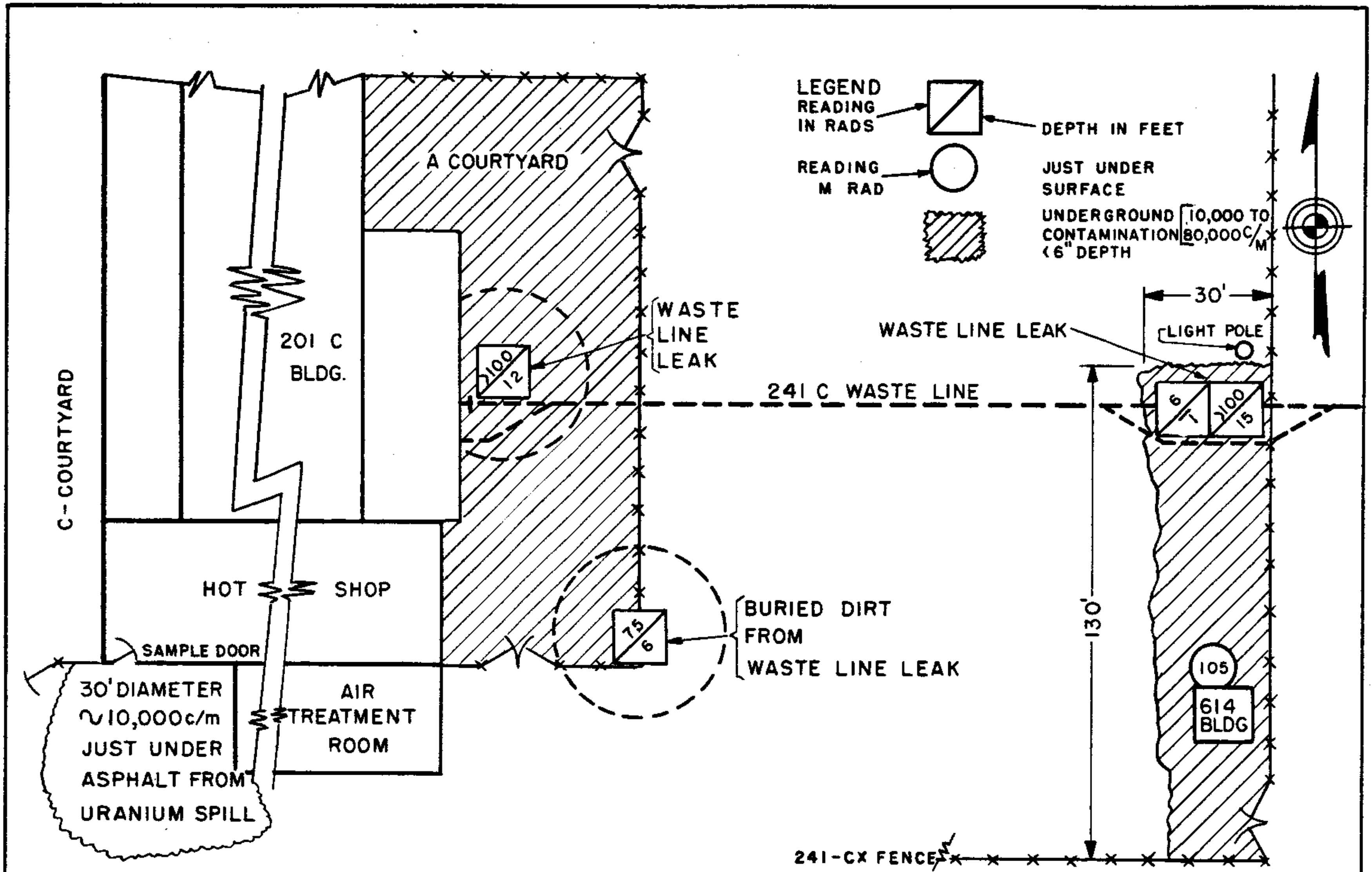
APPENDIX E.

UNDERGROUND CONTAMINATION



HOT SEMIWORKS UNDERGROUND CONTAMINATION

APPENDIX F

TANK DESIGNATION AND VOLUMES

201 C TANKS

Tank	Function	Vol. Gal.	Location
1	Dissolver	112	A
2	Wash Catch Tk	109	A
3	HAF Makeup	216	A
4	Col. Wash Tk.	50	271C
5	Scrubber	220	A
6	Oxidizer	204	A
7	HAF Feed Tk.	151	A
8	Cond. Catch Tk	234	A
9	IBP-Rec.2AF Feed	50	C
10	Cond. Catch	300	C
11	HAS IAS Feed	650	C
12	ICU Conc.	330	C
13	U Storage	1430	C
14	IBXF Feed	240	C
15	IOF	300	C
16	100	650	C
17	2BP Conc.	85	C
18	IOR	103	C
19	2BP Storage	21	C
20	IOW	100	C
21	IOT	1140	C
22	Aq-Catch Tk.	470	276C
23	Still	805	276C
24	Decanter	92	276C
25	Solvent Wash	620	276C
26	Storage	1720	276C
27	Makeup	620	276C
28	HAX	528	276C
29	IBS	281	276C
30	IAX	528	276C
31	2AX	143	276C
32	Makeup	323	271C
33	HNO_3	130	271C
34	NaOH	156	271C
35	HNO_3	179	271C
36	Makeup	92	271C
37	Makeup	660	271C
38	Makeup	28	271C
39	Makeup	208	271C
40	Makeup	208	271C
41	Makeup	470	271C
42	Weigh Tk.	92	271C
43	Weigh Tk.	27	271C
44	Sump	200	A
45	HAS HT.	144	271C
46	IBX HT.	73	271C
47	HCX HT.	323	271C
48	Drain Tk.	12	271C
49	IAS HT.	144	271C
50	ICX	323	271C
51	IOS	74	271C
52	2AS	22	271C
53	Weigh Tk.	12	271C
54	Cond. Hold	640	A
55	#1 Waste Conc.	560	A
56	$NaNO_2$	28	271C
57	IAF Feed	73	C
58	Overflow Catch	92	276C
59	Solv. Treat	660	276C
60	NaOH	135	276C
61	HNO_3	135	276C
62	Makeup	92	276C
63	H_2O	776	276C
64	Acid Fract.	54	A
65	H_2O	776	271C
66	Weigh Tk.	92	276C
67	HNO_3 Rec.	57	A
68	Makeup	70	271C
69	Neutralizer	226	A
70	U.G. Storage		241CX
71	Neut. to Crib		Crib
72	Self Conc.		241CX
73	#2 Waste Conc.	200	A
74	2 BX HT	27	271C
75	HNO_3	320	B
76	HCP Conc.	200	C
77	2 BP Recycle	6L	B
78	Decanter	233	C
79	Self-Conc. Catch		241CX
80	Acid Fract.		B
81	Fract. Rec		B
G-6	Aq. Cent		A
G-16	Org. Cent.		C

COLUMN	VOL. (l)	HT. (ft.)	COLUMN DIA. (IN.)	COLUMN AREA (ft.²)	DISENG. SEC. HT.	DISENG. SEC. DIA.	DISENG. SEC. I.F.	COLUMN CARTRIDGE MATERIAL TYPE	MAT.	PLATES NO.	PLATES GA.	PLATES SPAC.	HOLES DIA.	HOLES SPAC.	REMARKS	PISTON DIA.	MAXIMUM PISTON STROKE	K D_p^2/D_c^2	C VOLTS/IN
HA(ex)	108	8'-0"	3"	.051	2'-8"	6"	T	SIEVE PLATE	SS	48	16	2"	1/8"	1/4"	23% F.A.	4.00"	1.25"	1.78	3.89
HA(s)		14'-0"	3"	.051	3'-0"	8"		SIEVE PLATE	SS	80	16	2"	1/8"	1/4"	23% F.A.			1.78	
1A (ex)	105	8'-0"	3"	.051	2'-8"	6"	T	NOZZ. PLATE	SS	48	16	2"	3/16"	3/8"	23% F.A	4.00"	1.0"	1.78	3.89
1A (s)		15'-0"	4"	.088	3'-0"	8"	OR B	SIEVE PLATE	FLO SS	70 70	1/8" 16	1" 1"	3/16" .080"	3/8" 3/8"	23% F.A. 21% F.A			1.00	
1BX	88	18'-0"	4"	.088	2'-4" 2'-0"	8" 8"	T	SIEVE PLATE	SS	107	16	2"	1/8"	1/4"	23% F.A.	4.00"	1.0"	1.00	3.76
1BS	12.5	12'-0"	1"	.006	2'-4" 2'-0"	4" 4"	T	SIEVE PLATE	SS	70	25	2"	1/8"	1/4"	23% F.A.	Bellows 1.584"	1.375"	2.51	4.0 or 4.27
HC	150	10'-0"	4"	.088	2'-8" 5'-0"	8" 10"	T B	NOZZ PLATE	SS	30	1/16"	4"	1/8"	3/8"	NOZZ DEPTH .035" 10% F.A.	4.00"	1.5"	1.00	4.11
1C	150	10'-0"	4"	.088	2'-8" 5'-0"	8" 10"	T B	NOZZ PLATE	SS	30	1/16"	4"	1/8"	3/8"	NOZZ DEPTH .035" 10% F.A	4.00"	1.0"	1.00	4.0
2A(ex)	15	8'-0"	1½"	.014	2'-10"	3"	T	RASCH RINGS	FLO.	3/8" x 3/8" x 3/64" WALL (.226 ft³)						Bellows 2.280"	0.75"	2.31	3.71
2A(s)		8'-0"	1½"	.014	2'-0"	3"	OR B	RACH RINGS	FLO.									2.31	
2B	7.4	10'-0"	1"	.006	2'-4" 1'-6"	3" 2½"	T	SIEVE PLATE	SS	59	16	2"	.06	1/8"	21% F.A.	Bellows 1.485"	0.50"	2.2	3.93
10	200	16'-0"	5"	.139	1'-8" 4'-0"	12" 12"	T B	NOZZ. PLATE	SS	47	1/16"	4"	1/8"	3/8"	NOZZ. DEPTH .035" 10% F.A.	4.00"	1.25"	0.64	3.80
1F	204	38'-0"	4"	.088	2'-7" 3'-0"	12" 12"	T B	RASCH RINGS	FLO & SS	PACKED IN ALT. LAYERS OF 1' - 1st SS 1"x1" (1.7 FT³ SS & 1.7 FT³ FLO.)						—	—	—	—

Amplitude = K STROKE

Appendix H

HOT SEMIWORKS SAMPLER LOCATION - 201-C BUILDING

Helix No.	Sampler	No. of Sensing Units Per In-Line Sampler	Sampler Type		Jet Location		Function
			Tank	Line	8 CFM Sample Gallery	30 CFM Cell Tank	
A Cell							
301							Sampler jet air lift suction header
302	Off-Gas Sampler No. 1			X	X		
303	Off-Gas Sampler No. 2			X			
304							
305							
306	2A-1 (2AW)	1		X	X		In-line; Pu direct α
307	5 (Scrubber)		X		X		
308	1A-1 (1AW)	1		X	X		In-line; U Pol.
309	6 (Oxidizer)		X			X	
310	3 (HAF Conc.)	1	X			X	In-line; U Photo.
311	73 (No. 2 Waste Conc.)		X		X		
312	55 (Service Conc.)		X			X	
313	81		X		X		
314	44 (Sump)		X		X		
315*	7 (HAF)		X		X		
316*	HA-1 (HAW)	1		X	X		In-line; U Pol.
317*	69 (Waste Neutral.)		X		X		In-line; pH
318*	64 (No. Waste Conc.)		X			X	
319	67 (30% Acid Receiver)	1	X		X		In-line, γM
320	E-64 (1WD Cond.)	1		X	X		In-line, γM
321	8 (Cond. Receiver)		X		X		
322	54 (Cond. Hold.)		X		X		
323							
324							
325							
326	308 (Pond Hdr.)			X	X		
327	E-67 (AAA Cond.)			X	X		
	T-80 Trays 3-8						Manual-type samplers for acid vacuum fractionator
B Cell							
701	HA-2 (HAP)	2		X	X		In-line; U Photo., γM
702	HC-2 (HCW)			X	X		
703	1A-2 (1AP)	2		X	X		In-line; U Photo., γM
704	1BX-1 (1BSF aq.)			X	X		
705	1BX-2 (1BU)	2		X	X		In-line; U Photo., γM
706	1BS-2 (1BSU)			X	X		
707	1C-2 (1CW)			X	X		
708	2A-2 (2AP)	2		X	X		In-line; Pu Photo., γM
709	2B-1 (2BP aq.)			X	X		
C Cell							
301							Sampler jet air lift suction header
302							
303	21 (1OT)		X			X	
304	16 (1OO after)	2	X		X		In-line; γM; U Photo.
305							
306							
307	20 (1GW)		X			X	
308							HNO_3 to TK's 9 & 57; $NaNO_2$ to TK-9&57
309	11 (1AS;HAIS)		X			X	
310	1BS-1 (1BP)			X	X		
311	9 (2AF)	1	X		X		In-line; γM
312	76 (HCP)		X		X		
313	2B-2 (2BW)			X	X		
314	10 (Cond.)		X			X	
315	17 (1BP, 2BP Conc.)		X			X	
316	57 (1AF)	2	X			X	In-line; U Photo.; γM
317	2A-1 (2AW)			X	X		
318	19 (PR)		X			X	
319	12 (1CU Conc.)		X			X	
320	1-0-0 Before	1		X	X		In-line; γM
321	14 (1BXF)		X			X	
322	HC-1 (HCP)			X	X		
323	15 (1OF)	1	X		X		In-line; γM
324	1C-1 (1CU)			X	X		
325	18 (1OR)	1	X		X		In-line; pH
326	13 (U Storage)		X			X	
327	309 (Pond Hdr.)			X	X		
	TK-75 (HNO_3)		X				Manual-type sampler for TK-75 HNO_3

* Remote Sampling Facilities (Gilmont Sampler).

JET NO.	CELL	FROM Tank	FROM Nozzle	TO Tank	TO Nozzle	Lift Ft. of H_2O	Disch.	Flow GPM	PIPE SIZE Suct.	PIPE SIZE Disch.	PIPE SIZE Steam	HELIX NO.
J-1-1	A	1	7	2	7	5.8	1	10	1	1	1	A-803
J-1-2	A	1	8	6	1	5.7	2	10	1	1	1	A-805
J-1-3	A	1	7	69 Hdr.	5	5.8	12	10	1	1	1	A-804
J-2	A	2	1	1	3	4.0	1	10	1	1	1	A-505
J-3-1	A	3	3	6	7	5.7	1	10	1	1	1	A-813
J-3-2	A	3	13	7	1	5.0	13	10	1	1	1	A-814
J-3-3	A	3	4	69 Hdr.	5	5.0	21	10	1	1	1	A-811
J-5-1	A	5	13	69 Hdr.	5	4.8	19	10	1	1	1	A-604
J-5-2	A	5	10	2	4	6.5	1	3	½	1	½	A-808
J-6-1	A	6	2	3	12	6.7	19	10	3/4	1	1	A-510
J-6-2*	A	6	14	G-6	3	11.0	0	¼	1	1	1/8	A-409
J-G-6	A	G6	2	69 Hdr.	5	2.5	8	10	1	1	3/4	A-507
J-7-1	A	7	3	3	10	7.5	13	10	1	1	1	A-514
J-7-2	A	7	10	11	12	7.5	21	3	1	1½	½	A-604
J-8-1	A	8	10	54	11	6.6	1	10	1	1	1	A-520
J-8-2	A	8	8	73	7	6.6	1	~~10~~	3/4	1	½	A-420
J-9	C	9	1	T-17		7.0	14	3	½	1	½	C-513
J-10	C	10	3	54	7	7.0	4	10	1	1	½	C-816
(J-11-1	C	11	1	73	10	8.4	10	10	1	1½	½	C-510
J-11-2)	C	11	4	76	8	8.4	2	10	1	1	½	C-508
J-12-1	C	12	6	21	11	9.0	5	10	1	1	½	C-822
J-12-2	C	12	11	13	9	9.0	10	20	1	1	½	C-825
J-13-1	C	13	10	12	10	11.1	1	10	1	1	½	C-827
J-13-2	C	13	2	57	8	11.0	1	10	1	1	½	C-830
J-14	C	14	3	15	7	7.5	4	10	1	1	½	C-523
(J-15-1	C	15	1	21	6	8.5	4	10	1	1	½	C-826
J-15-2)	C	15	2	G-16	4	8.5	9	3	½	½	½	C-528
J-G-16	C	G16	4	20	4	2.0	1	3	½	½	½	C-808
J-16-1	C	16	14	21	4	8.4	4	10	1½	1½	3/4	C-505
J-16-2	C	16	5	14	8	8.4	1	10	1	1	½	C-805
J-16-3	C	16	3	11	5	8.4	1	10	½	½	½	C-804
J-17-1	C	17	5	9	1	8.0	7	3	1	1	½	C-516
J-17-2	C	17	7	55 Hdr.		7.8	5	10	1	1	½	C-518
J-17-3	C	17	3	19	3	8.0	1	3	1	½	½	C-517
J-18	C	18	1	55 Hdr.		7.8	21	10	1	1	½	C-529
J-19	C	19	1	17	1	5.5	10	3	½	½	½	C-620
(J-20-1	C	20	1	55 Hdr.		7.4	14	10	1	1½	½	C-810
J-20-2)	C	20	5	78	4	7.0	10	3	½	3/4	½	C-809
(J-21-1	C	21	7	78	5	11.0	6	10	1½	1	3/4	C-806
J-21-2	C	21	11	76	1	11.4	3	10	1	1	½	C-706
J-21-3)	C	21	4	78	6	11.0	5	10	1	1	½	C-706

* Air Jet

UNCLASSIFIED

HOT SEMIWORKS - TRANSFER JETS

APPENDIX I

UNCLASSIFIED

APPENDIX I (Cont'd)

HOT SEMIWORKS - TRANSFER JETS

JET NO.	CELL	FROM		TO		Lift	Disch.	Flow	PIPE SIZE			HELIX NO.
		Tank	Nozzle	Tank	Nozzle	Ft. of H_2O		GPM	Suct.	Disch.	Steam	
(J-44-1	A	44		Crib or	TK-26	5.5	25-55	10	1	1	½	A-417
J-44-2)	A	44		55	7	5.5	17	20	2	2	3/4	A-516
J-44-3	A	44		69	1	5.5	18	20	1½	1½	3/4	A-426
J-54-1	A	54	1	55	11	8.4	1	10	1	1	1	A-525
J-54-2	A	54	10	Crib	Hdr.	8.4	19	20	1½	1½	3/4	A-526
J-55-1	A	55	12	54	13	7.8	1	20	2	1½	1	A-822
J-55-2	A	55	1	69	1	7.0	1	20	1½	1½	½	A-825
J-55-3	A	55	2	73	5	7.8	1	10	1½	1	½	A-824
J-57	C	57	1	76	5	5.0	6	10	3/4	1	½	C-620
J-64-1	A	64	2	69	14	4.7	2	10	½	1	½	A-819
J-64-2	A	64	2	55	11	4.7	10	10	1	1	½	A-524
J-67-1	A	67	1	73	5	3.7	3	10	1	1	½	A-823
J-67-2	A	67	11	81	9	4.0	47	10	1	1½	½	A-527
J-69-1	A	69	12	241C	A-918	5.0	25	20	1½	2	1	A-818
J-69-2	A	69	13	55	6	5.0	3	10	1	1	½	A-820
J-69-3	A	69	13	3	10	5.0	2	10	1	1	½	A-828
J-69-4	A	69	6	21	5	5.0	30	20	1½	1½	3/4	A-518
J-69-5	A	69	4	TK-72	A-9	5.0	2	20	1½	2	3/4	A-730
(J-69-6)	A	69	8	64	7	5.0	1	3	½	1	½	A-428
J-73-1	A	73	4	64	6	4.5	3	10	1	1	½	A-412
J-73-2	A	73	6	69	8	4.5	10	10	3/4	1	½	A-411
J-73-3	A	73	2	5	10	4.5	12	10	1	1	½	A-414
(J-76-1)	C	76	6	57	7	4.5	6	10	½	1	½	C-820
(J-76-2)	C	76	4	55-Hdr		4.5	12	10	3/4	1½	½	C-727
J-76-3	C	76	1	7	10	4.5	9	3	½	½	½	C-813
(J-76-4)	C	76	2	21	6	4.5	10	3	½	1	½	C-727
(J-76-5)	C	E-76-2		57	7	6.0	1	10	1	1	½	C-526
J-77	B	77		T-17		4.5	1	3	½	½	½	B-605
J-78-1	C	78	2	55 Hdr.		5.0	1	3	½	½	½	C-703
(J-81)	B	81	8	73	11	4.8	15	10	1½	1½	½	A-530
(J-HA	B	HA	15	69 Hdr.		3.0	1	3	½	3/4	½	B-Door
J-1A)	B	1A	15	69-Hdr.		3.0	1	3	½	3/4	½	B-Door
J-P-7*	A	P-7		7	1	8.0	1	¼	½	½	½	A-424
Pan Jet	A	Pan		44-Hdr.		2.0	1	10	1	1	½	A-701

* Air Jet
( ) Common Control Switch

APPENDIX J

HOT SEMIWORKS FUNCTIONAL HAMMEL DAHL VALVES

FUNCTION	VALVE	HAMMEL DAHL Body	HAMMEL DAHL Plug	CONTROLLER Instrument	CONTROLLER Panel	ΔP Ft. Water	OPERATION Air To	LOCATION
HAX (Cold)	C-20	½"	#1	PSV-202	22	12	Open	B-Cell N Wall
1AX (Cold)	49	½"	#2	PSV-49	19	12	Open	B-Cell W Wall
1BS (Cold)	12	½"	#7	PSV-12	17	13	Open	B-Cell W Wall
2AX (Cold)	46	½"	#7	PSV-46	15	16	Open	B-Cell W Wall
2AR	206	½"	#8	PSV-206	14	3.5-16	Open	C-Cell
1AP Filter Bypass	C-19	½"	#1	PSV-C-19	20	12	Open	B-Cell N Wall
TK-80 Drain	TK-80	½"	#1	PSV-TK-80		10	Open	B-Cell E Wall
TK-75 Hdr. to TK-2	75-2	½"	#1	PSV-75-2	0	4.5	Open	B-Cell E Wall
TK-75 Hdr. to TK-3	75-3	½"	#1	PSV-75-3	0	8	Open	B-Cell E Wall
TK-75 Hdr. to TK-11	75-4	½"	#1	PSV-75-4	0	6.5	Open	B-Cell E Wall
TK-78 to TK-15 or 21	78-1	2"	2"	PSV-78-1	11	3	Close	C-Cell
TK-78 to TK-55 or 21	78-2	2"	2"	PSV-78-2	11	2.5	Close	C-Cell
*2BW to TK-14 or 15	2BW	1"	1"	PSV-78-3	11	8	Open	C-Cell
*CW to TK-21 or TK-15	1CW-HCW	1"	1"	PSV-78-4	11	3.5	Open	C-Cell
**100 Bypass G-16	G-16-2	½"	½"	PSV-78-5	11	3.5	Open	C-Cell
HAF Filter Bypass	C-21	½"	#1	PSV-C-21	22	25-55	Open	B-Cell E Wall
HAF Filter Bypass	C-22	½"	#1	PSV-C-22	22	25-70	Open	B-Cell E Wall
HAF Filter Backflush	C-23	½"	#1	PSV-C-23	22	20-70	Open	B-Cell E Wall
HAF Filter Drain	C-24	1"	½"	PSV-C-24	22	44-200	Open	B-Cell E Wall
G-6 to TK-3 or TK-6	G-6	1"	1"	PSV-G-6	2	.5	Three Way	A-Cell
P-21 to TK-16	21-1	1"	¼"	PSV-21-1	9	70	Open	C-Cell
P-21 to TK-16 or 23	21-2	1"	¼"	PSV-21-1	9	70	Open	C-Cell
P-21 to P-21 Hdr.	21-3	1"	¼"	P-21 SOL.	9	70	Open	C-Cell
Tower or Tank-12	T-12	1"	3/16	PSV-T-12	6	12	Close	C-Cell
Tower or Tank-17	T-17	½"	#1	PSV-T-17	8	16	Open	C-Cell
Tower or Tank-73	T-73	1"	3/16	PSV-T-73	24	23	Close	A-Cell
Tower or Tank-76	T-76	1"	3/16	PSV-T-76	10	13	Close	C-Cell
G-16 to TK-16 or 21	G-16-1	1"	3/16	PSV-G-16	11	1	Close	C-Cell
P-16 to P-16 Hdr.	16	1"	¼"	P-16 SOL.	7	70	Open	C-Cell
Off-Gas Filter Drain	F-1	½"	#1	PSV-F-1	1	1.5	Open	A-Cell
Off-Gas Via E-1-1	E-1-1	2"	2"	PSV-E-1-1	1	0	Open	A-Cell
Off-Gas Via E-1-2	E-1-2	2"	2"	PSV-E-1-1	1	0	Open	A-Cell
J-44-2 Blowback	J-44-2	2"	2"	PSV-44-1	0	0	Close	A-Cell
Spare	E-73-1	1"	½"				Open	
Spare	TK-64	1"	½"				Open	
Spare	T-64	½"	#1				Open	

NOTES:
*AVECO Engineering AOV(No backup bellows)
** Research Control Valve
[illegible] of water

APPENDIX J - Cont'd

HOT SEMIWORKS FUNCTIONAL HAMMEL DAHL VALVES

STREAM	VALVE	CONTROLLER	HAMMEL DAHL		PRESSURE DROP PSI	VALVE RANGE		LOCATION
			Body	Plug		MIN. (ml/min)	MAX.	
HAF	7	FRC-C-1	½"	#5	22	35	1800	B-Cell N Wall
HAF (Alt)	C-17	FRC-C-1	½"	#5	22	35	1800	B-Cell W Wall
HAIS (Hot)	203	FRC-31	½"	#7	19	15	700	B-Cell N Wall
HAS (Cold)	C-4	FRC-45	½"	#3	5	40	1900	C-Valve Room
HAX (Hot)	C-6	FRC-47	½"	#1	20-5	150-100	7-5000	B-Cell N Wall
HAW	201	IRC-201	½"	#3	11	60	3000	B-Cell E Wall
HCX	C-8	FRC-C-2	1"	3/16"	4.8	170	8500	C-Valve Room
HCP	C-7	IRC-202	1"	¼"	2.5-8	200-360	10-18000	C-Valve Room
1AF	29	FRC-C-4	½"	#4	21	50	2600	B-Cell W Wall
1AIS (Hot)	C-15	FRC-29	½"	#5	19	35	1800	B-Cell W Wall
1AS (Cold)	C-3	FRC-49	½"	#3	5	40	1900	C-Valve Room
1AX (Hot)	C-10	FRC-C-3	½"	#1	20-5	120-100	6000-5000	B-Cell W Wall
1AW	C-9	IRC-203	½"	#3	4.5-10	40-55	1900-2700	B-Cell W Wall
1BS (Hot)	C-5	FRC-12	½"	#5	26-6	15-19	760-910	B-Cell W Wall
1BP	204	IRC-204	½"	#6	9.3	15	740	B-Cell W Wall
1BXF	28	FRC-B-3	½"	#2	20	135	6500	B-Cell W Wall
1BX	C-12	IRC-205	½"	#5	5	17	840	C-Valve Room
1BSF	205	FRC-7	½"	#3	3	30	1500	B-Ce 11 W Wall
1CX	C-11	FRC-C-5	½"	#1	4.7	100	5000	C-Valve Room
1CU	C-1	IRC-206	1"	¼"	1.5-8	150-320	7-16000	B-Cell W Wall
2AF	C-16	FRC-28	½"	#5	22	36	1800	B-Cell W Wall
2AS	52	FRC-52	½"	#9	5	3	130	C-Valve Room
2AX (Hot)	51	FRC-17	½"	#7	22-7	10-8	480-380	B-Cell W Wall
2AW	207	IRC-207	½"	#5	2.5-8	12-20	600-1100	B-Cell W Wall
2BX	47	FRC-C-6	½"	#10	5	17	85	C-Valve Room
2BP	17	IRC-C-1	½"	#10	1.5-7	1-2	40-95	B-Cell W Wall
1FF (1OF)	C-21	FRC-50	½"	#1	10	140	7000	B-Cell W Wall
1FW	202	IRC-C-3	½"	#1	19	200	10000	B-Cell W Wall
1OS or 1FS	C-2	FRC-46	1"	3/16"	5-1	170-100	8500-5000	C-Valve Room
1OR	C-14	FRC-30	½"	#3	21	84	4200	B-Cell W Wall
1OW	C-13	IRC-C-2	½"	#2 *	8	84+	4200+	B-Cell W Wall
AF HNO_3	45	FRC-51	½"	#6	2	7	340	C-Valve Room
2AF HNO_3	50	MCS-45	½"	#7	3	5	260	C-Sample Gal.
AFF	T-80	FRC-T-80-F	½"	#7	28-14	15-11	760-570	B-Cell E Wall
PLM	C-18	MCS-C-7	½"	#8	4	3.6	180	B-Cell N Wall
TK-75 Acid	75-1	MCS-75-1	½"	#1	1.5-3	64-70	3200-3500	B-Cell E Wall
OFF-GAS	JET	TK-1 CON.	½"	#1 *				Fan House 291C
HPC	E-76-2	MCS-E-76-2	1"	3/16"	0-1		0-4500	C-Cell

NOTES:
(1) Valve Ranges are calculated, minimum range about 1/50 of maximum
(2) Pressure Drop does not include ΔP for fluid flow lost in line before or after valve.
(3)* Special Plug
(4) All valves Air to Open

APPENDIX K

HOT SEMIWORKS INSTRUMENT DATA SHEET

STREAM	SOURCE	CONTROLLER	RECORDER	TRANSMITTER	AVAILABLE RANGE MIN (ml/min)	MAX	ROTOMETER FLANGE SIZE	CONTROL VALVE
HAIS	P-11	FRC-31	FRC-31	FTC-19	120	420	½"	203
HAS	TK-45	FRC-45	FRC-45	FT-45	30	340	½"	C-4
HAX	P-16 or	FRC-47	FRC-47	FT-A-3	300	3800	1"	C-6
	TK-28	PSV-202	FRC-47	FT-A-3	300	3800	1"	C-20
HAW	HA Col.	IRC-201	FR-3-1	FT-A-1	100	1600	1"	201
HAF	P-7	FRC-C-1	FRC-C-1	FT-C-22	100	1000	½"	7
	P-57	FRC-C-1	FRC-C-1	FT-C-24	100	1000	½"	C-17
HCX	TK-47	FRC-C-2	FRC-C-2	FT-C-2	500	5000	1"	C-8
HCP	HC Col.	IRC-202	FR-1-1	FT-C-3	500	5000	1"	C-7
HCW	HC Col.		FR-1-2	FT-C-4	240	2400	1"	
IAS	TK-49	FRC-49	FRC-49	FT-C-23	30	320	½"	C-3
IAIS	P-11	FRC-29	FRC-29	FT-29	40	370	½"	C-15
IAX	P-16 or	FRC-C-3	FRC-C-3	FT-C-5	270	2300	1"	C-10
	TK-30	PSV-49	FRC-C-3	FT-C-5	270	2300	1"	49
IAF	P-57	FRC-C-4	FRC-C-4	FT-C-6	100	1000	½"	29
IAW	IA Col.	IRC-203	FR-1-3	FT-C-7	150	1300	1"	C-9
IBXF	P-14	FRC-B-3	FRC-B-3	FT-B-5	700	4400	1"	28
IBX	TK-46	IRC-205						C-12
IBSF	IBX Col	FRC-7	FRC-7	FT-B-1	30	190	½"	205
IBSU	IBS Col		FR-3-3	FT-47	60	420	½"	
IBS	P-16 or	FRC-12	FRC-12	FT-12	40	360	½"	C-5
	TK-29	PSV-12	FRC-12	FT-12	40	360	½"	12
IBP	IB Col.	IRC-204	FR-3-2	FT-7	40	360	½"	204
ICX	TK-50	FRC-C-5	FRC-C-5	FT-C-9	500	5000	1"	C-11
ICW	IC Col.		FR-3-4	FT-A-2	600	3500	1"	
ICU	IC Col.	IRC-206	FR-1-5	FT-C-10	500	5000	1"	C-1
2AF	P-9	FRC-28	FRC-28	FT-28	140	720	½"	C-16
2AS	TK-52	FRC-52	FRC-52	FT-52	6	60	½"	52
2AX	P-16 or	FRC-17	FRC-17	FT-C-26	40	170	½"	51
	TK-31	PSV-46	FRC-17	FT-C-26	40	170	½"	46
2AW	2A Col.	IRC-207	FR-2-6	FT-50	40	450	½"	207
2BX	TK-74	FRC-C-6	FRC-C-6	FR-C-11	6	60	½"	47
2BW	2B Col.		FR-2-4	FT-C-18	40	170	½"	
2BP	2B Col.	IRC-C-1	FR-2-1	FT-C-12	6	60	½"	17
IFF(IOF)	P-15	FRC-50	FRC-50	FT-C-14	1000	6000	1"	30
IOR	P-18	FRC-30	FRC-30	FT-C-15	140	720	1"	C-14
IOW	IO Col.	IRC-C-2	FR-2-2	FT-C-21	140	1300	½"	C-13
IOO	IO Col.		FR-2-3	FT-C-16	600	6000	1"	
IOS or	TK-51	FRC-46	FRC-46	FT-46	20	200	½"	C-2
IFS				FT-49	200	2000	1"	C-2
AFF	P-67 or TK-75	FRC-T-80-F	FRC-T-80-F	FT-C-25	100	1000	½"	T-80
AF-HNO_3	TK-33	FRC-51	FRC-51	FT-31	40	170	1"	45
2AF-HNO_3	TK-33	MCS-45	FR-2-5	FT-C-17	10	100	½"	50
IFW	IF Col.	IRC-C-3						202
IAP	IA Col.		FR-1-4	FT-C-8	250	2300	1"	

APPENDIX L

DECONTAMINATING SOLUTIONS

Contamination	Code	COMPOSITION (Wt.%)	Application Temperature
Ru	PC	1-1/2% $KMnO_4$ (Permanganate) 1/2% NaOH (Caustic)	60° C
Ru	CP	5% NaOH (Caustic) 2% H_2O_2 (Peroxide)	40° C
Zr-Nb	CT	6% NaOH (Caustic) 1 1/2% Tartaric acid (Tartrate)	80-100° C
Zr-Nb	CTP	6% NaOH - 1 1/2% Tartaric acid 2% H_2O_2 (Caustic-Tartrate-Peroxide)	25-30° C
Zr-Nb	HF	5% HNO_3 - 1% NaF (Nitric-Fluoride)	25-30° C
MnO_2 (from PC)	N-F-FAS	5% HNO_3 - 1% NaF - 2% $Fe(NH_4)_2(SO_4)_2$ (Nitric-Fluoride-Ferrous Ammonium sulfate)	25-30° C
MnO_2	N-FAS	5% HNO_3 - 2% $Fe(NH_4)_2(SO_4)_2$ (Nitric-Ferrous Ammonium Sulfate)	25-30° C
All	3-20	6.9% NaF - 27.7% HNO_3(3% HF-20% HNO_3)	25-30° C
Zr-Nb	OX	5% $H_2C_2O_4$ (Oxalic Acid)	80° C
Grease plus FP	TSP	2% Na_3PO_4 (Trisodiumphosphate)	80-100° C
Ce, Cs	ND	6 Molar HNO_3 - 10% Sodium Dichromate	50° C
Pu	SD	Mixture of sulfuric acid and sodium dichromate	50° C
All	Oakite	10-20% Oakite #31	
on Masks	Turco	1-14% Turco 4182A	

NOTE: Exposure to solutions may vary from 15 minutes to 2 hours.

APPENDIX M

HOT SEMIWORKS EQUIPMENT LOAN RECORDS

Date Loaned	Loaned To:	Description	HEW No.	Coments	Date Returned
9-19-56	R.Dierks-3706 Bldg-(G.Alkire)	Beckman Model V Micro-Micro-Ammeter	431551		
9-19-56	R.Dierks " " "	Sorensen Nobation Voltage Regulator Model #-6-5A	434279		
9-22-56	RW McKee 224-U	Head from P-56-3		Plastic	
12-21-56	Purex Inst. Dept	Deteckto Lab. Log Count Meter	434168		
12-21-56	GJ Alkire-3706 Bldg	Polarograph Panel Unit	423961		
	Purex CPD Operation	Absorptiometer-Brown Recorder	431637		5-1-57
1-8-57	RE Connally	A1A Pre Amp. for Spectrometer	430314		
4-18-57	MJ Szulinski-224-U	Weston Ammeter Fielden Telstor 30' Low Capacitance Cable Belden K-109A Capacitance Probe	414518	For column I.F. control at HSW	12-6-57
4-25-57	CL Pleasance (GJ Alkire)	Beckman Model V Micro-Micro-Ammeter	431423		
4-25-57	CL Pleasance (GJ Alkire)	Beckman Model V Micro-Micro-Ammeter	431424		
	J Allen(RJ Browning)	1 set of 4 Long Lockers from 2707 1 all steel Pipe Rack		Moved to 200-E General Maint. Shop	
	Chem Eng. Dev. Group	3 large and 1 sm Metal Desks 3 Cushioned swivel chairs			
	JG Bradley	Calculator	365387		
8-28-57	LF Badger-2722-E	Type 513 Techtronic Scope w/portable stand	431463		
9-9-57	TF Evans (321-A)	2 AS Rotameter			

UNCLASSIFIED

UNCLASSIFIED

UNCLASSIFIED

APPENDIX M

HOT SEMIWORKS EQUIPMENT LOAN RECORDS

Date Loaned	Loaned To:	Description	HEW No.	Comments	Date Returned

UNCLASSIFIED

HW-52860

UNCLASSIFIED

APPENDIX M

HOT SEMIWORKS EQUIPMENT LOAN RECORDS

Date Loaned	Loaned To:	Description	HEW No.	Comments	Date Returned

UNCLASSIFIED

APPENDIX N

DOCUMENTS OF INTEREST

HOT SEMIWORKS REFERENCES*

Miscellaneous

Number	Description
H-2-4108 Sht 1-46	Hot Semiworks Drawing List
HW-22955	Hot Semiworks Manual, Part I
HW-22956	Hot Semiworks Manual, Part II
Sk 2-50078	Hot Semiworks Purex Flow Diagram
Undocumented	Hot Semiworks Operating Procedures (In Semiworks File)
Undocumented	Hot Semiworks Connector (Helix) List (In Semiworks File)
HW-31373	Purex Chemical Flow Sheet HW #2
	Blue Print File (Vendor information on equipment) (File at Semiworks)
HW-34523	Operation and Maintenance Manual - Inline Analytical Instruments of the Hot Semiworks
HW-31000	Purex Technical Manual
	Spare Parts Inventory List (in Semiworks File)

* See Appendix on File Contents for minor items.

Redox Operations Reports

HW-31767 Hot Semiworks Redox Studies

Purex Operations Reports

HW-38768 RD	PX-1
HW-38769 RD	PX-2
HW-38770 RD	PX-3
HW-41198 RD	PX-4
HW-39786 RD	PX-5
HW-39063 RD	PX-6
HW-39517 RD	PX-7
HW-39828 RD	PX-8
HW-40281 RD	PX-9
HW-43074 RD	PX-10
HW-44520 RD	PX-11
HW-48090 RD	PX-12
HW-45047 RD	PX-13
HW-49824 RD	PX-15
HW-49551 RD	PX-16
HW-49673 RD	PX-18

APPENDIX N (Continued)

Miscellaneous Reference Documents

Number	Title
HW-27277	Purex Chemical Flowsheet HW#2
HW-28217	Heat Generation in Radioactive Wastes
HW-29576	Sandblast Decontamination of Stainless Steel
HW-30325	Vacuum Nitric Acid Fractionation in the Purex Plant
HW-30325	The Removal of Ruthenium Contamination from Surfaces by Alkaline-Permanganate
HW-30600	Vacuum Nitric Acid Fractionation in the Purex Plant
HW-31275 RD	Agenda for Hot Semiworks Purex Studies
HW-31373	Purex Chemical Flowsheet HW#3
HW-31962	Pilot Plant Studies of Purex 100 Clarification by a 40-in. Bird Liquid-Liquid-Solid Centrifuge
HW-31968 RD	Report on Visit to Chemical Processing Plant, Idaho Falls, Idaho
HW-32212	Effects of Dissolving Conditions on Fission Product Behavior in Purex
HW-32896	Preliminary Flowsheet for the Removal of Ruthenium from 60% UNH Solution by Ozone Sparging
HW-33053	Effect of Solvent Saturation on Decontamination in the Purex HA Extraction-Scrub System
HW-33180	Table of Plutonium Build-up and Uranium Depletion
HW-33296	The Path of UX_1 in the Purex Process
HW-40550 Vol 2	Purex Pulse Column Studies with Hydrocarbon Diluent
HW-47712	Process Specifications for Operational Control-Purex Plant
AD-157	Evaluation of Vacuum Blasting Equipment for Decontamination-Phase 1
BNL-C-8415	Studies on Adsorption of Ruthenium on Stainless Steel
AD-314	Cocontamination of Painted Surfaces by Steam Cleaning
HW-42978	High-Capacity Purex Study Flowsheet
HW-42565	A Design Basis for Tank Farm Vapor Systems
HW-42111	Counting Methods and Calculations used by the Analytical Laboratories Separations Section
HW-42079	Feasibility of Increasing Purex Plant Capacity Through Use of a Redox Flowsheet
HW-41890	Recovery of Plutonium from Purex 1WW by Anion Exchange
HW-41834	The Corrosion of 304-L Stainless Steel Under Purex Acid Recovery Concentrator Conditions
HW-40829	Interim Progress Report Examination of Soltrol - TBP Solvent with Respect to Zr-Nb Decontamination
HW-40230	Simplified Study Flowsheet No. 2 Modified Redox Process
HW-40136	Tentative Process Improvement Program for Purex Plant
HW-39879	Present Facilities, Capabilities, and Limitations B. Larger Facilities
HW-38675	Considerations in Recovery of Acid in the Purex Plant
HW-38263	The Stability of Purex Solvent to Radiation and Chemical Attack
HW-37624	In-Line Analytical Instrumentation for Separations - Process Control at Hanford - An Interim Summary

APPENDIX N (Continued)

Miscellaneous Reference Documents - Continued

Number	Title
HW-37272	In-Line Alpha Monitor Prototype Performance
HW-37210	Simplified Study Flowsheet for Uranium Processing
HW-34502 Rev	Investigation of Solvent Degradation Products in Recycled Uranium Recovery Plant Solvent
HW-34501	Chemical Stability of Purex and Uranium Recovery in Recycled Uranium Recovery Plant Solvent
HW-33922	Relationship between MWD/T and F Factor for Use in Purex Hot Semiworks
HW-33682	Partition of Dibutyl Phosphate
HW-33479	Ruthenium in the Purex Process
CF-52-2-189	ORNL Purex Pilot Plant - Data Manual
CF-53-4-190	Decontamination Procedures
KAPL-493	Cell No. 1 Decontamination During December 1950
ORNL-1242	Decontamination of ORNL Purex Pilot Plant
ORNL-1826	Decontamination of Stainless Steel
HW-45620	Ruthenium Behavior in Nitric Acid Distillation
HW-42637	Process Polarography: Some Problems in the Automatic Determination of Uranium in Nitric Acid
HW-40313	An Analysis of the In-Line Uranium Photometer Data from Purex Hot Semiworks - Runs PX-2 through PX-9

APPENDIX O

HOT SEMIWORKS RECORDS (RECORD CENTER)

Box Number	Code	Location	Labels
HA 53796	HA 230-450	2938	HSW notes on Redox HR 1 through HR 12
HA 53796	HA 230-451	2938	HSW Accountability
HA 53797	HA 230-452	2938	Makeup Sheet, Redox
HA 53797	HA 230-453	2938	Ozone studies
HA 53797	HA 230-454	2938	Purex Px 3A through Px 7
HA 53798	HA 230-455	2938	Px 8 through Px 18
HA 53799	HA 230-456	2938	Px 19 through Px 22
HA 53799	HA 230-457	2938	CP-2 through CP-3
HA 53800	HA 230-458	2938	CP-2 through CP-3 Summary
HA 53800	HA 230-459	2938	Px 1 through Px 3 Summary
HA 53800	HA 230-460	2938	Px 14 Px 22 Summary
HA 53800	HA 230-461	2938	Tank Calibration Curves
HA 53801	HA 230-462	2938	Sample Results
HA 53801	HA 230-463	2938	Purex Conversion of HSW
HA 53824	HA 230-478	2559	HSW Waste Self Concentration
HA 53824	HA 230-479	2559	HSW Accountability
HA 53824	HA 230-480	2559	HSW Shift Supervisors' Files
HA 53825	HA 230-481	2559	Operating Information, Curves, Calibrations, and Instructions
HA 53826	HA 230-481	2559	Operating Information, Job Hazards Break-down, SWP, SOP
HA 53827	HA 230-482	2559	HSW Construction Notes
HA 53828	HA 230-483	2559	HSW Pulser Information
HA 53828	HA 230-484	2559	HSW Demineralizer
HA 53828	HA 230-485	2559	HSW Final Maintenance
HA 53829	HA 230-486	2559	HSW Supervisor's File

APPENDIX P

221-T Equipment Storage

In 1950, twelve boxes of equipment were removed from 221-T headend testing cells to prepare a site from the Ra la equipment. This equipment is identical to that used in 321 Building during the phosphate separation program in 1945. The equipment is as follows:

Equipment Number	Description	RPG No.	BPF or Dwg. No.	RMU Survey at Box Surface 2-13-57
1510 1511 1512	3-1/2x4' 309 SCb Jacketed tks.	2383 1/2	W-62803-A	5 mr at 2"
1513 1514 1516 1517	24x32" - 309 SCb Jacketed tks.	1368 1/2	BPF-74177	300 c/m - 2 mr at 2"
1507 1508 1509	1 hp Philly gear agitators for 13-14-16-17	2164 1/2		Sides not accessible No count on top
1502 1503	10-20 hp - 26" stainless steel pancake centrifuge	831 1/2	BPF-69945	2 mr at 2"
1504	1000 lb charge stainless steel dissolver	2215 1/2	W-62801	25 mr at 2"

APPENDIX P

241 CX Storage

This area was used to store contaminated pieces of equipment for future use. Although a complete inventory has not been made, the following are known to be stored:

1. A-67 -- Eastern agitator, nozzle-type mount (This was installed, but removed and never used.
2. P-21 -- Submerged turbine pump used on Tank 21 during the Redox process.
3. Two large tanks used for ozonation studies.
4. One sparger tower used for ozonation.
5. One scrubber tower used for ozonation.
6. "T"-bar for riggers -- used on pump removal
7. Jumper decontamination box, shielding and drum
8. Hot Semiworks slug charger, sling and cover tank.
9. One portable pump
10. Various types of scaffolding and boards.
11. Two large agitator motors
12. One 1/4-hp motor
13. One 5-hp motor

APPENDIX P (Continued)

Miscellaneous

1. Raschig Rings - 6 boxes 1/4", 1 Box 3/8"
2. One Box of nozzles, one box of plates
3. One box of plastic nozzle (Helix) Stoppers
4. One Electric Heater
5. Eleven boxes of Pulser Parts
6. One Box of In-line Instrument Valve Exts. Handles.
7. Jumper for filling Purex U trailer
8. Alpha Monitor, pump, motor, etc. - 1 Box
9. One Sewer Snake - used for cell drains.
10. Pump Parts - 5 boxes (Chempumps)
11. One Moto Air (RMU) Contaminated 5-25-56
12. Impact Wrench Socket

Instrument Department Material

1. 4 Manometers
2. 2 Rotameters (piped together)
3. 5 Press gages
4. 8 Purge Rators
5. 1 Rotometer

Electrical and Welding Equipment

1. 6 Long-welding leads plus 3 stingers
2. 8 Extension or drop cords
3. 2 Large light Reflectors - complete
4. 2 Expansion-Proof Light Bulb Shields
5. 1 Small fuse box
6. 1 Expansion-Proof drop cord

Valves - Jets - Flanges - Tools

1. 13 Flanged valves, miscellaneous sizes
2. 1 Box spark-proof tools
3. 1 3/4" electric drill
4. Approximately 50' 1/4" or 3/8" hydraulic steel cable
5. Approximately 25' 3/4" hydraulic steel cable
6. 3 Hydraulic jacks
7. 4 Large jets - 2" flanges
8. 2 Large flanges approximately 18" diameter
9. 1 Box miscellaneous flanges (moved to Hot Semiworks)
10. 2 Chain falls
11. 1 Block and tackle

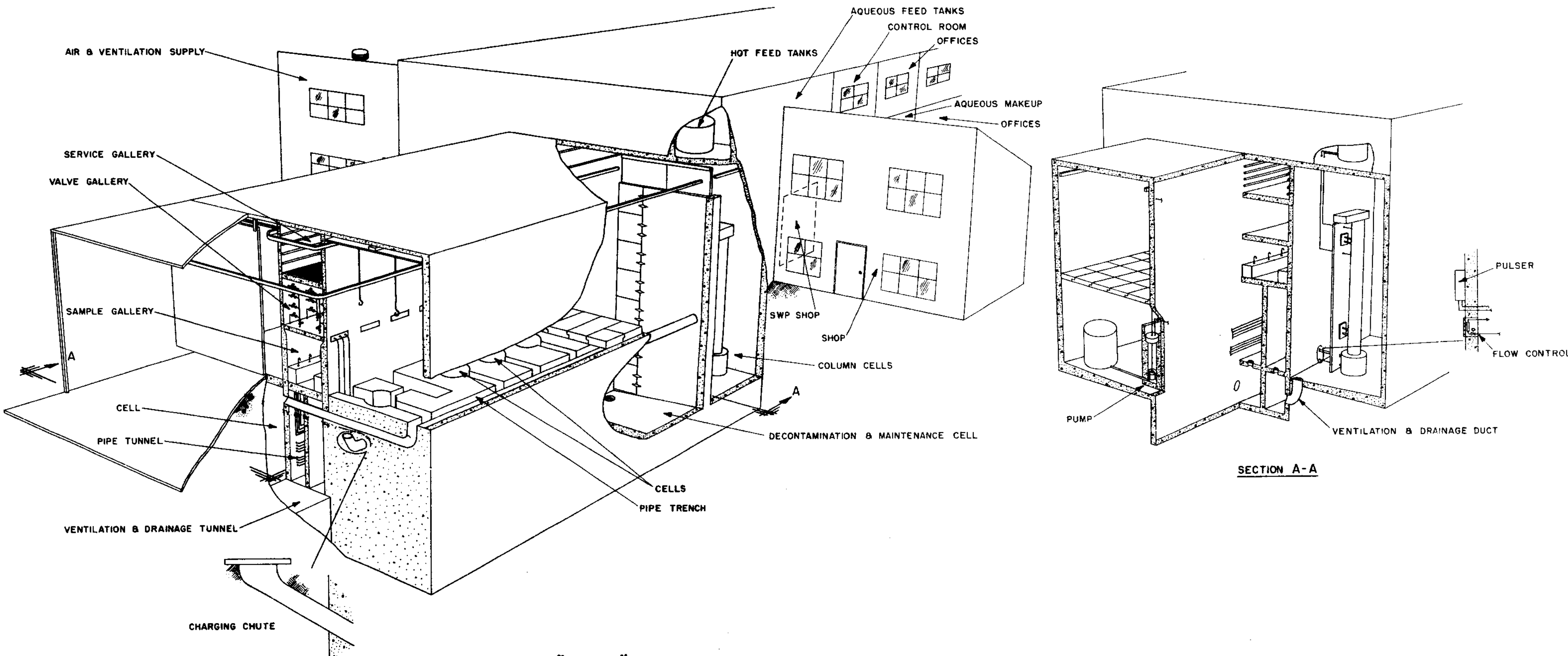
APPENDIX P (Continued)

Painting Supplies

1. 2 gal Cleaner
2. 1 gal White Paint
3. 1 good 4" Paint Brush
4. Approximately 75' hose for spray painter.

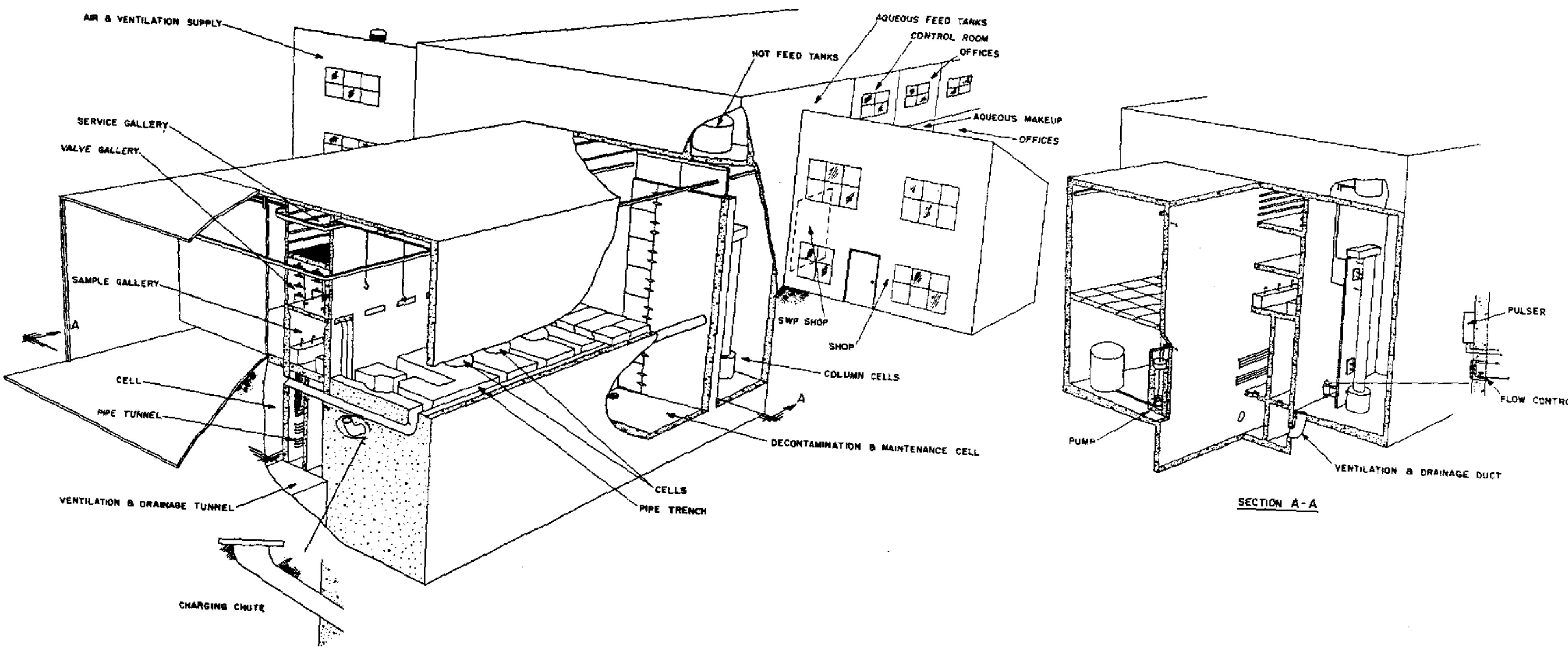
Operations Supplies

1. 1 Teflon sample carrier
2. 1 Trombone sample carrier
3. 1 5 gal. Carboy
4. 1 4 l Vac. flask
5. Approximately 20' Tygon tubing
6. U Trailer loading hose



AN "IDEAL" CONTACT MAINTAINED FACILITY

APPENDIX Q



AN "IDEAL" CONTACT MAINTAINED FACILITY

APPENDIX Q